US007363753B2

(12) **United States Patent**
Gates et al.

(10) **Patent No.: US 7,363,753 B2**
(45) **Date of Patent: Apr. 29, 2008**

(54) **METHOD FOR REMOVING A POUCH FROM A PLURALITY OF POUCHES INCLUDING BENDING AND PULLING OF THE POUCH**

(75) Inventors: **Anthony H. Gates**, Alliance, OH (US); **Scott E. Gates**, Atwater, OH (US)

(73) Assignee: **Gates Automation, Inc.**, Alliance, OH (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/335,338**

(22) Filed: **Jan. 19, 2006**

(65) **Prior Publication Data**

US 2006/0162291 A1 Jul. 27, 2006

Related U.S. Application Data

(60) Provisional application No. 60/646,910, filed on Jan. 25, 2005, provisional application No. 60/646,213, filed on Jan. 22, 2005.

(51) **Int. Cl.**
B65B 43/18 (2006.01)

(52) **U.S. Cl.** **53/459**; 53/469; 53/571; 53/284.7; 53/384.1; 53/386.1

(58) **Field of Classification Search** 53/459, 53/571, 386.1, 384.1; 221/210, 211; 271/106; *B65B 43/18*

See application file for complete search history.

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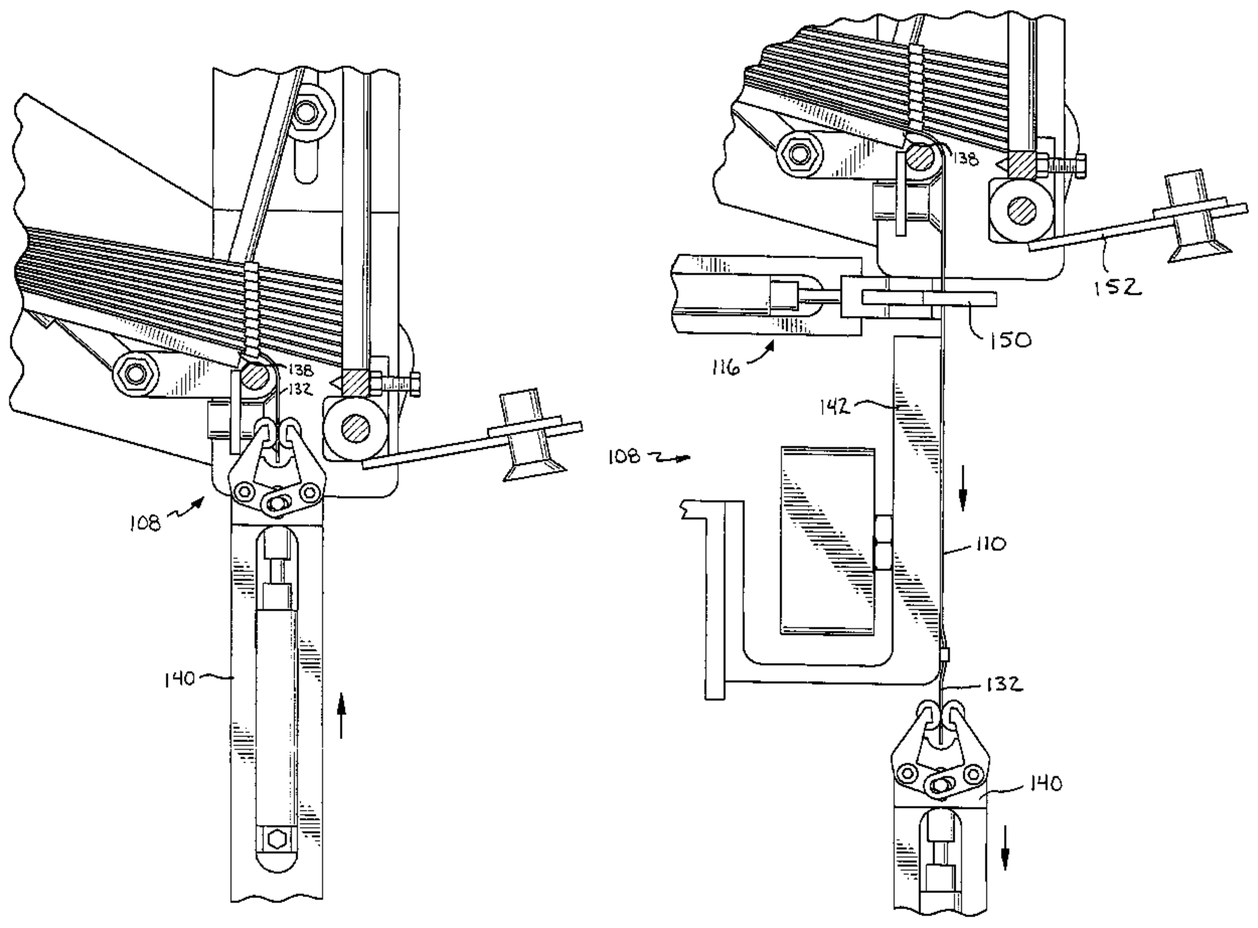
Primary Examiner—Stephen F. Gerrity
(74) *Attorney, Agent, or Firm*—Zollinger & Bueleson Ltd.

(57) **ABSTRACT**

A method and apparatus for removing the first pouch from a stack of pouches includes apparatus adapted to bend an edge of the first pouch away from the second pouch of a stack to define a bent edge and a bend in the first pouch. The first pouch is then slid away from the second pouch to remove the first pouch from the plurality of adjacent pouches. This method allows the first pouch to be reliably separated from the second pouch by overcoming the various forces that typically cause adjacent pouches to cling to each other while stacked together.

15 Claims, 80 Drawing Sheets



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* cited by examiner

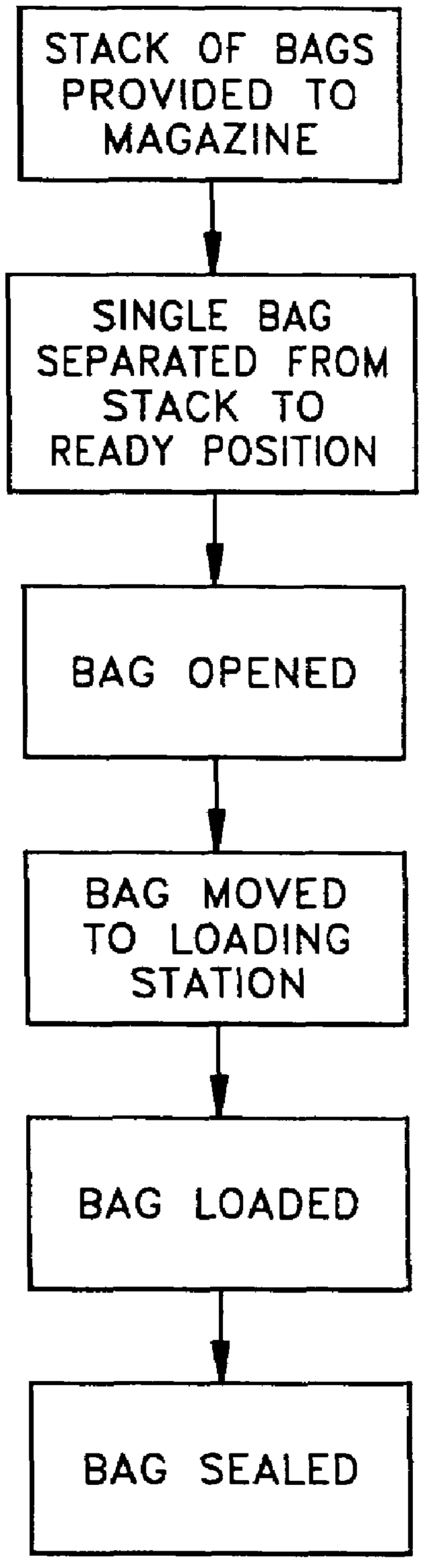

STACK OF BAGS PROVIDED TO MAGAZINE
SINGLE BAG SEPARATED FROM STACK TO READY POSITION
BAG OPENED
BAG MOVED TO LOADING STATION
BAG LOADED
BAG SEALED

FIG-1

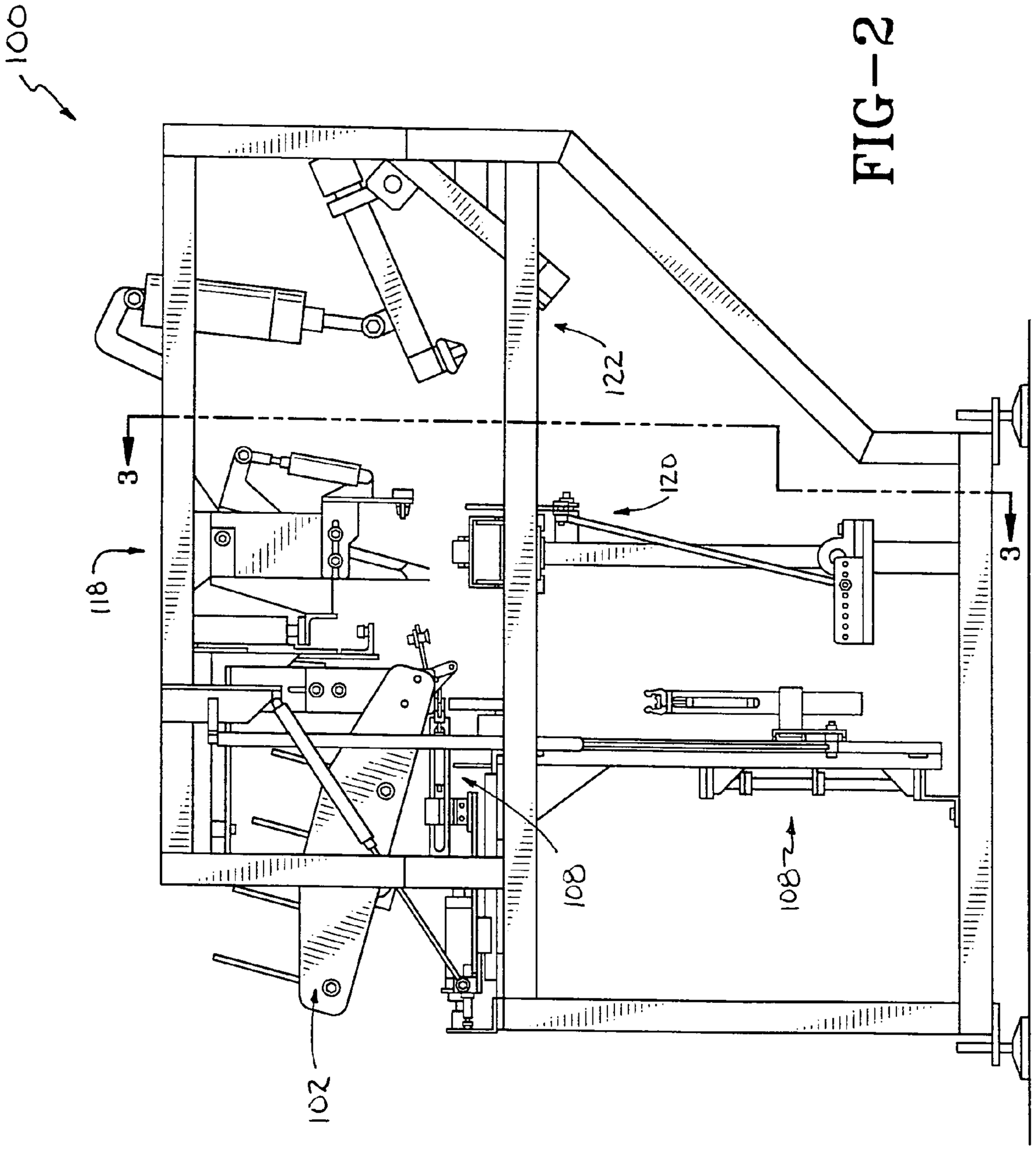


FIG-2

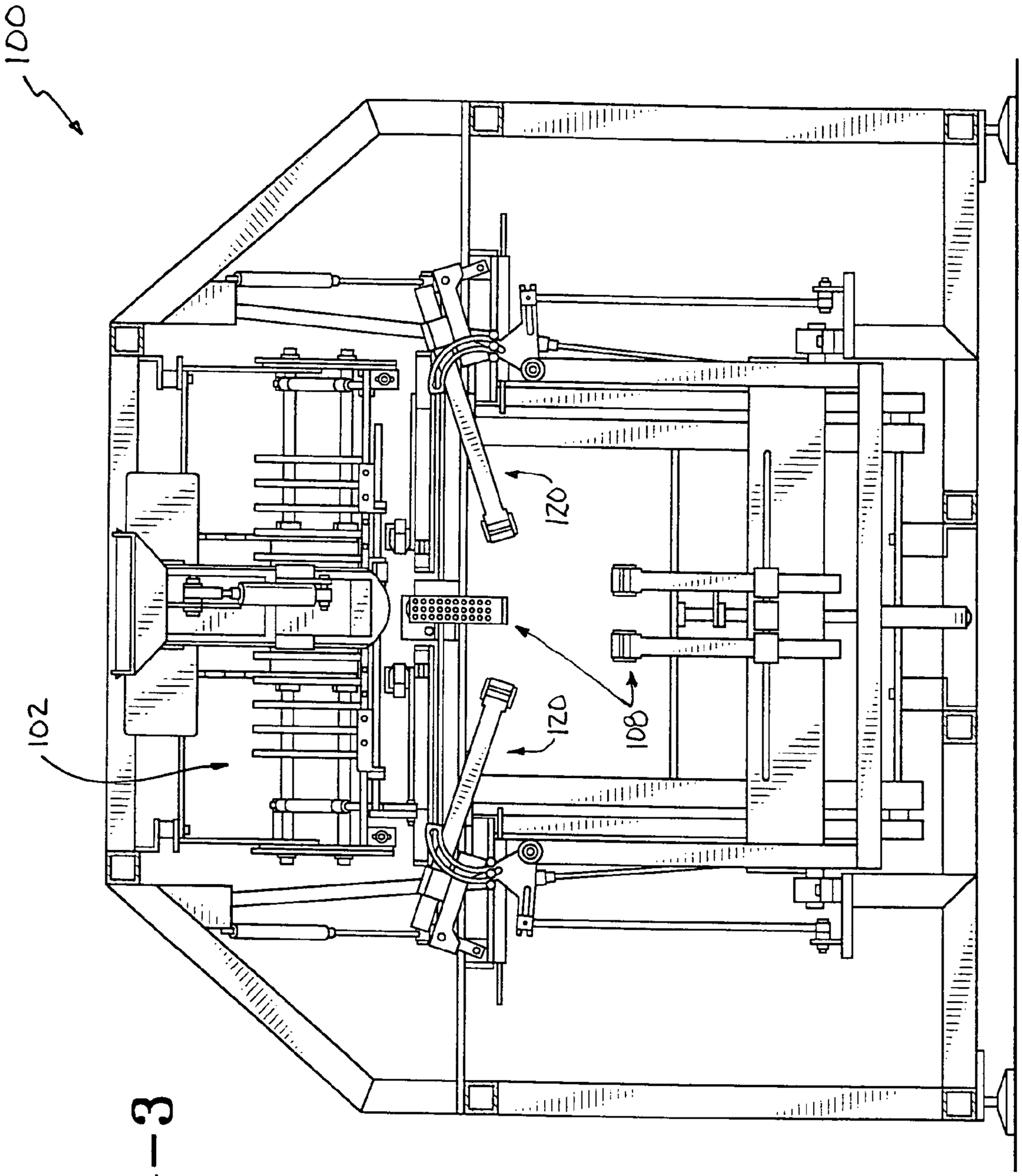


FIG-3

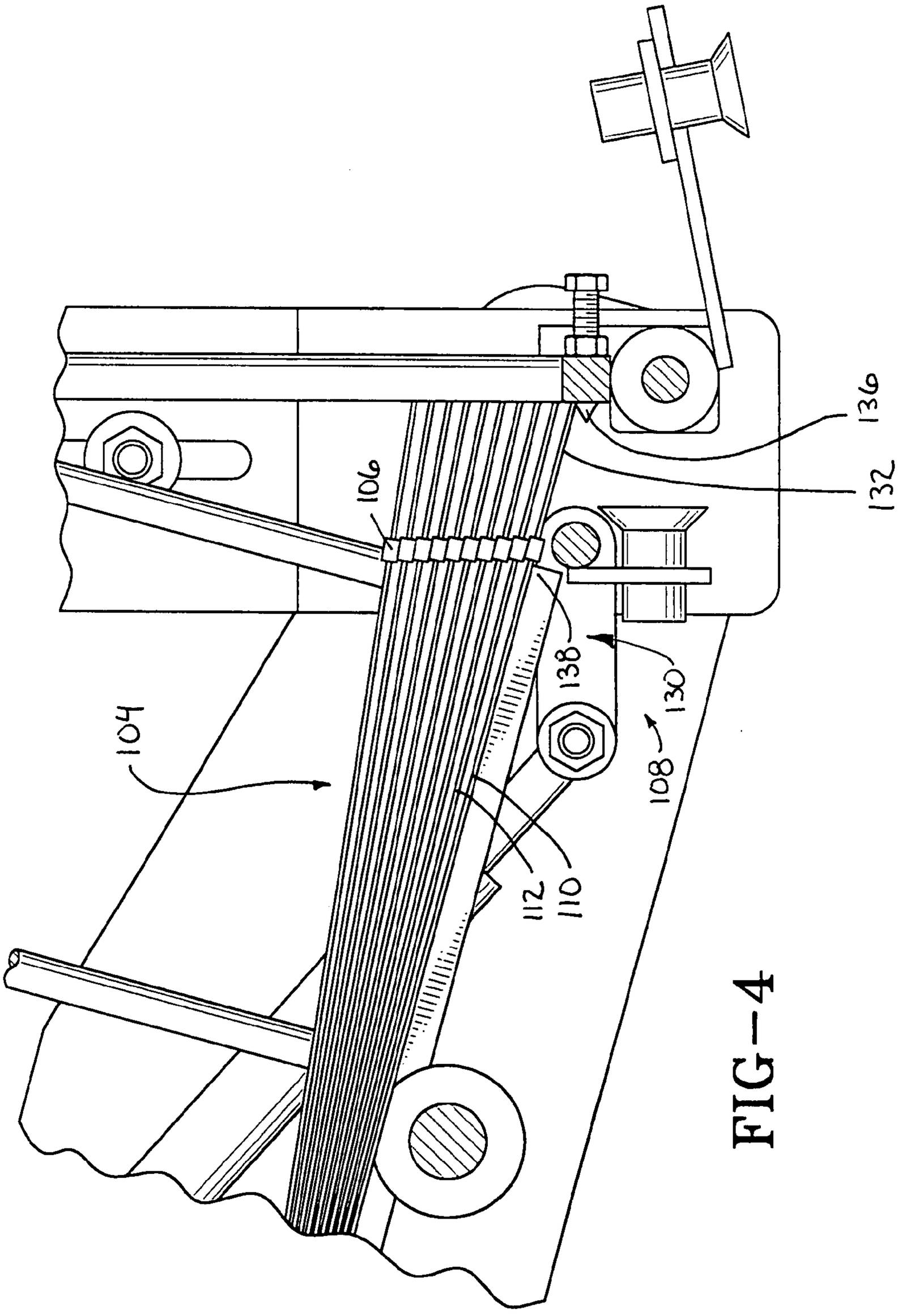


FIG-4

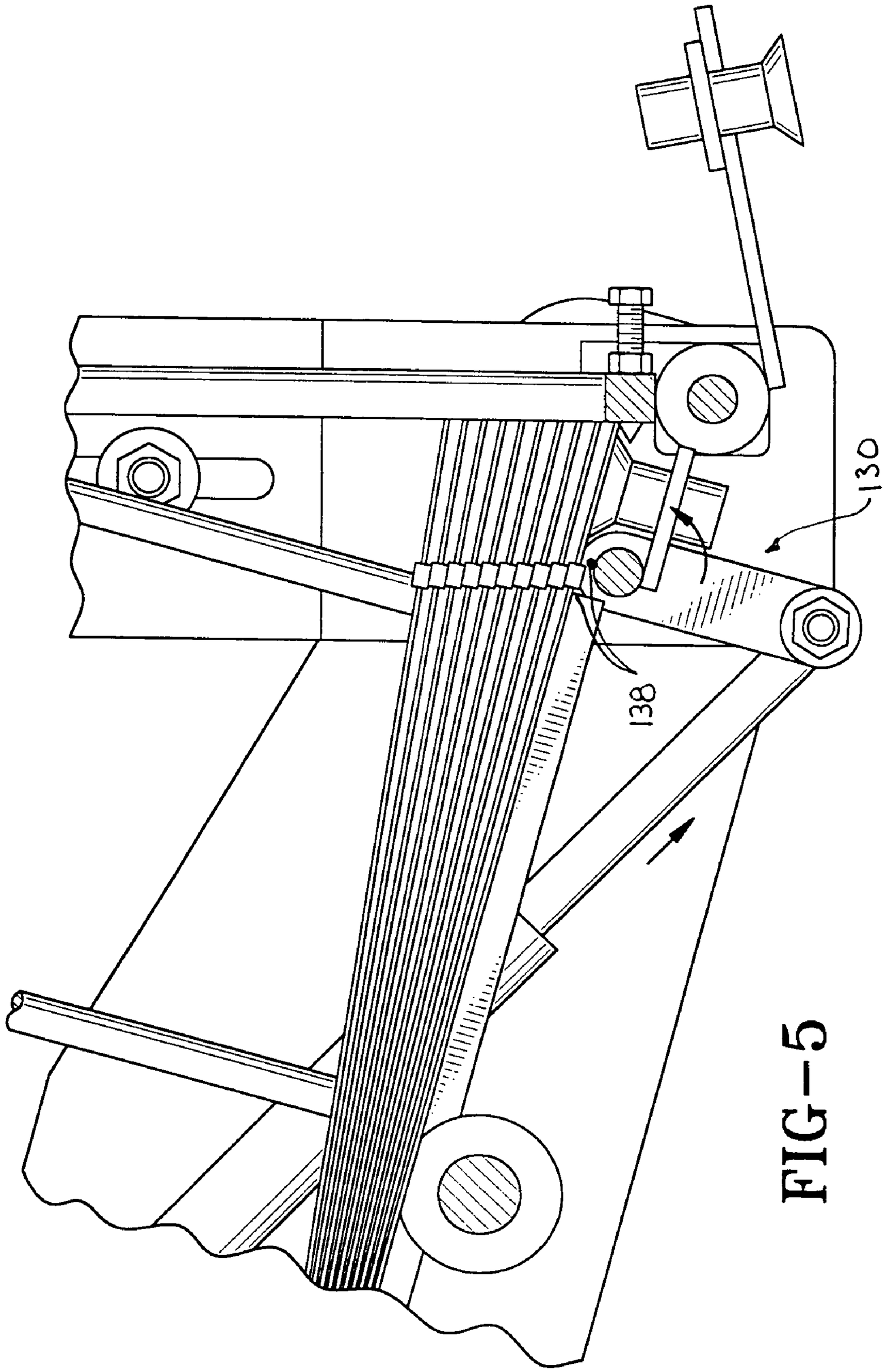
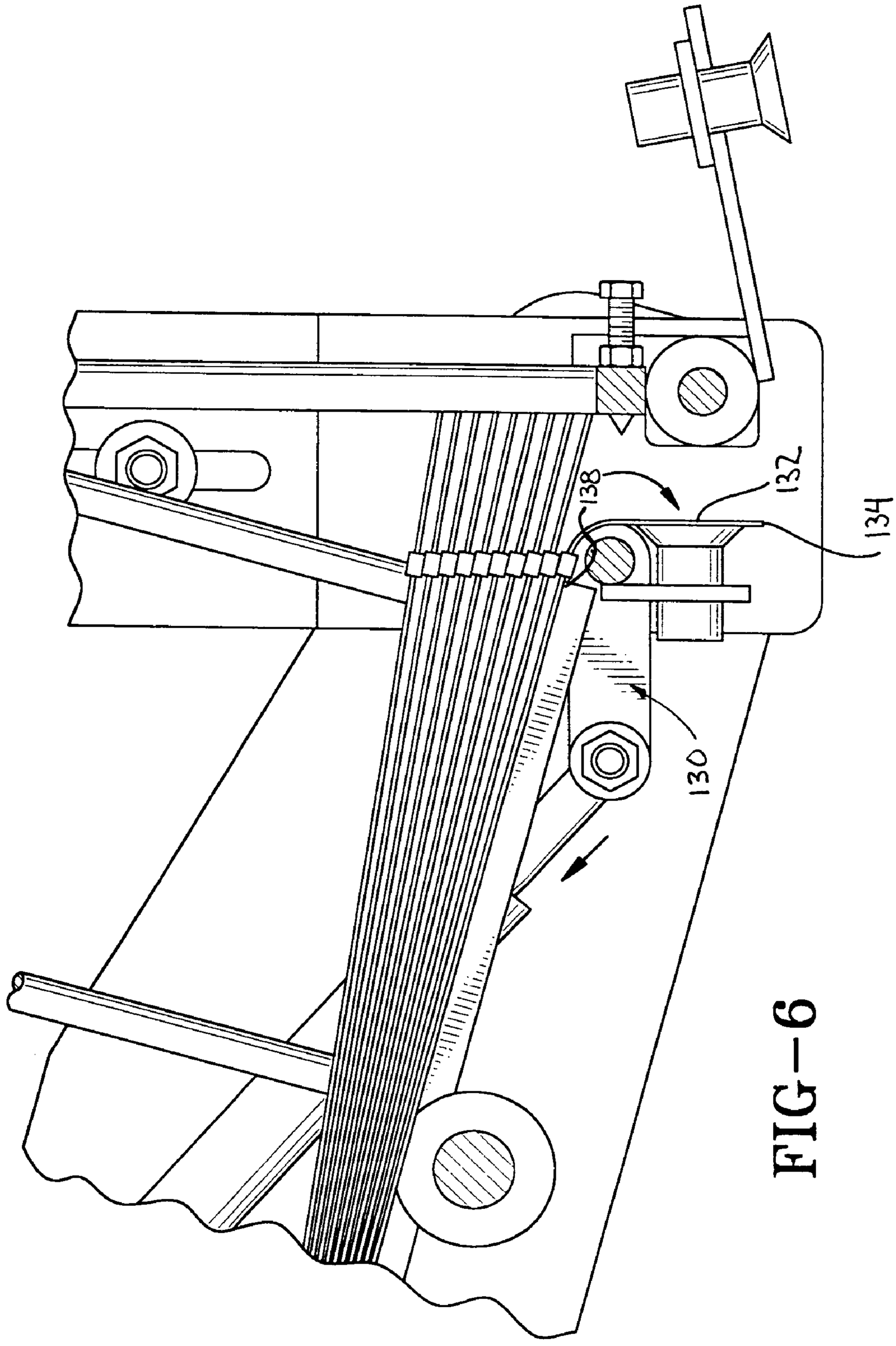


FIG-5



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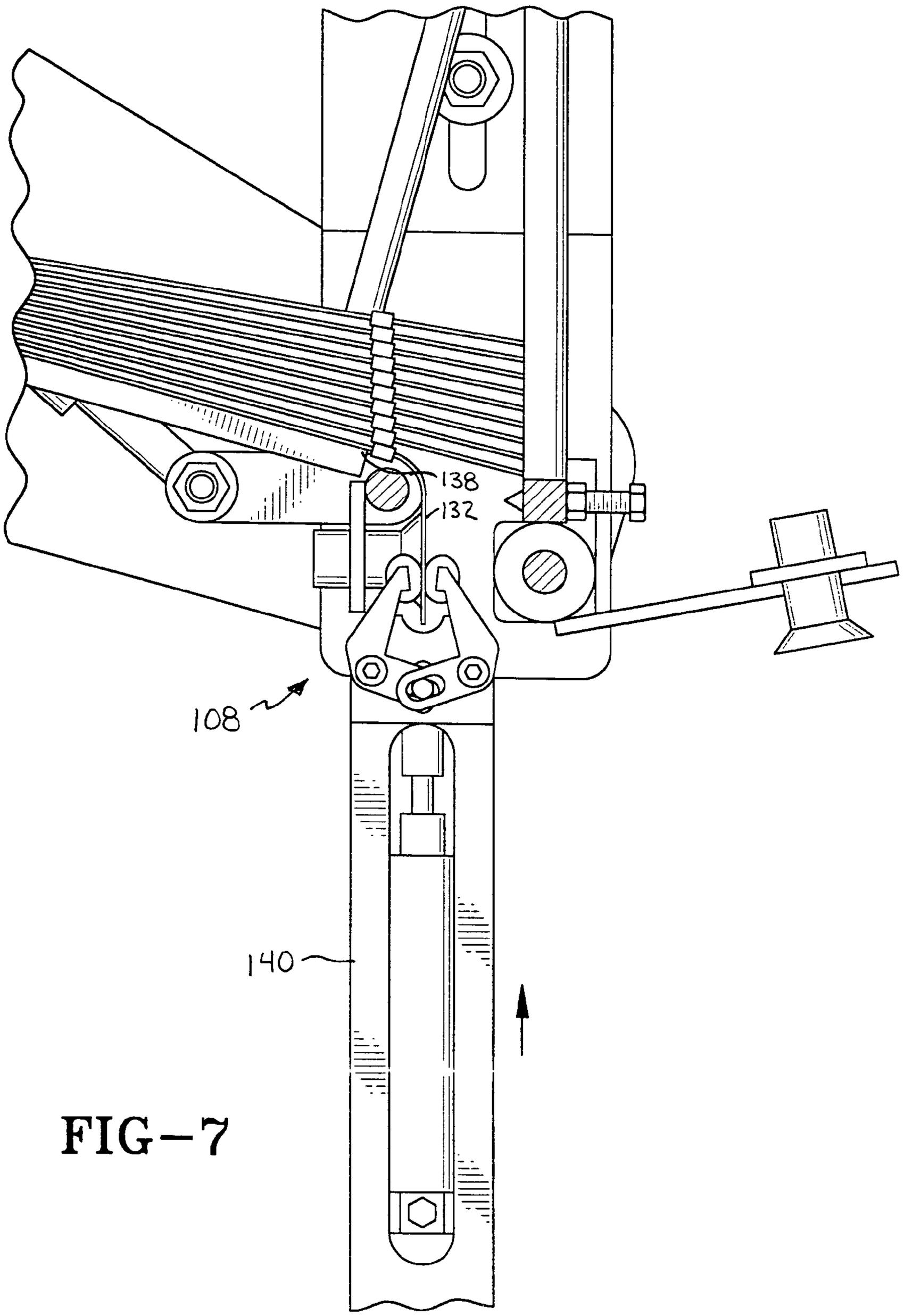

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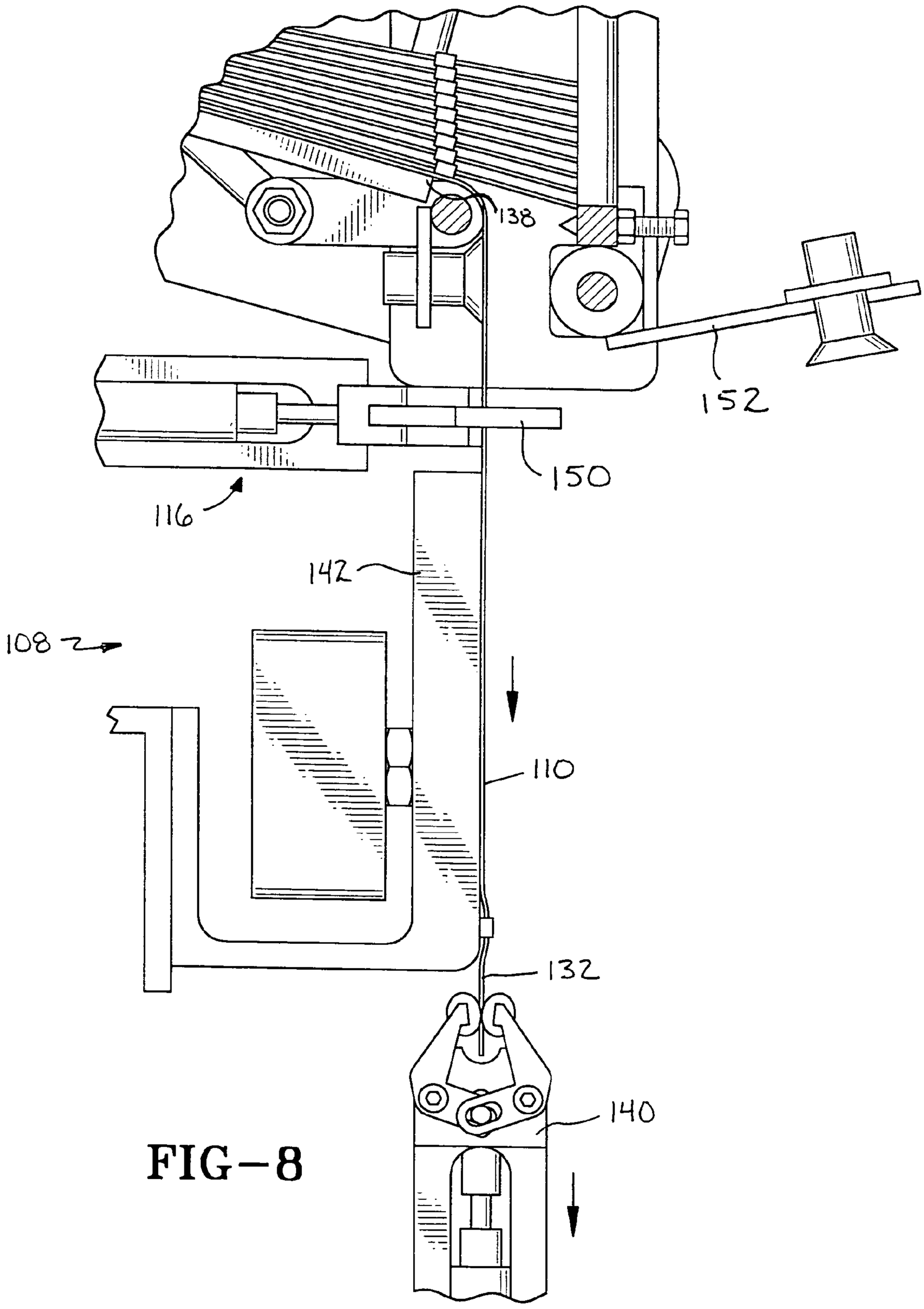

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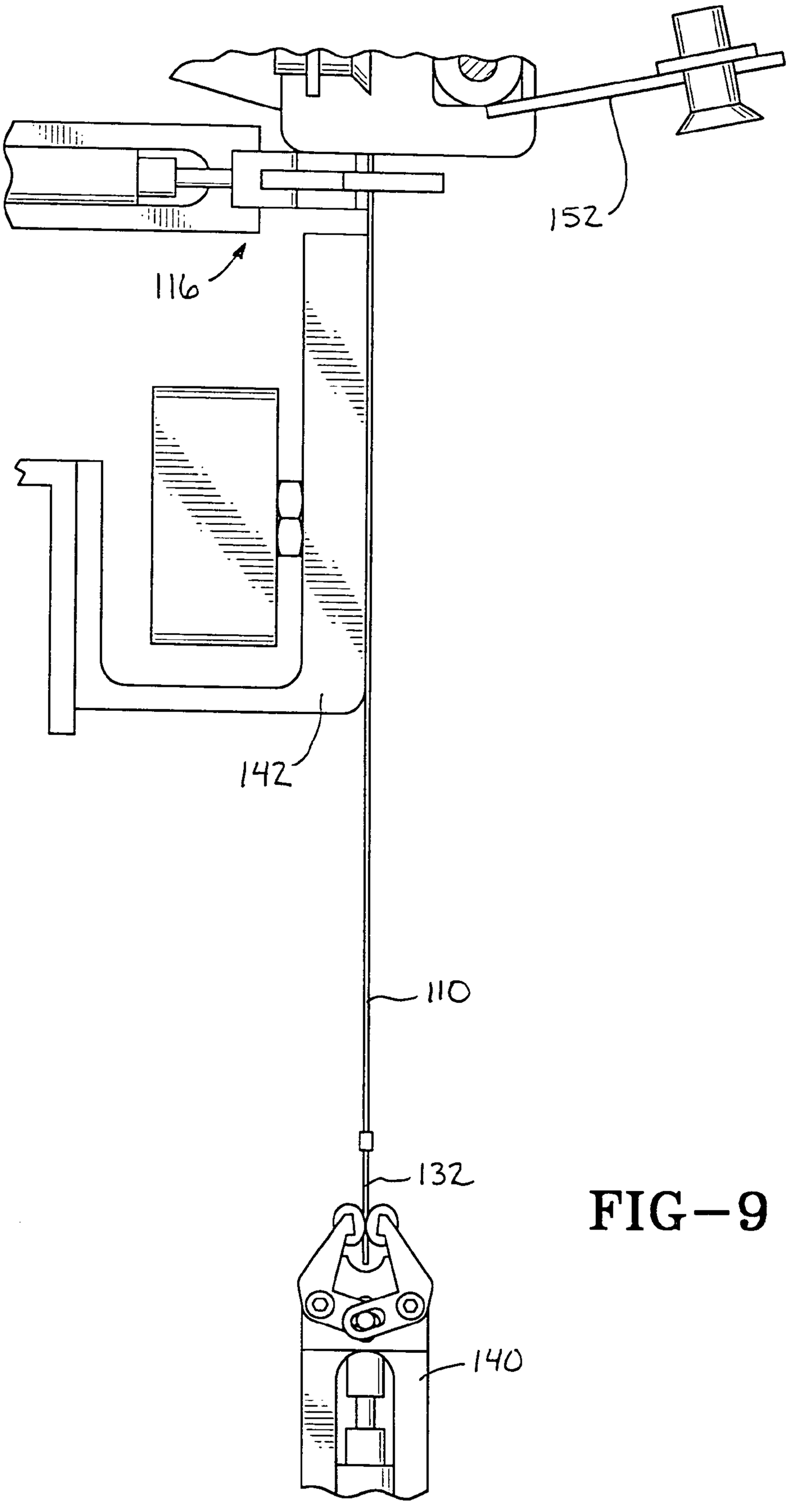

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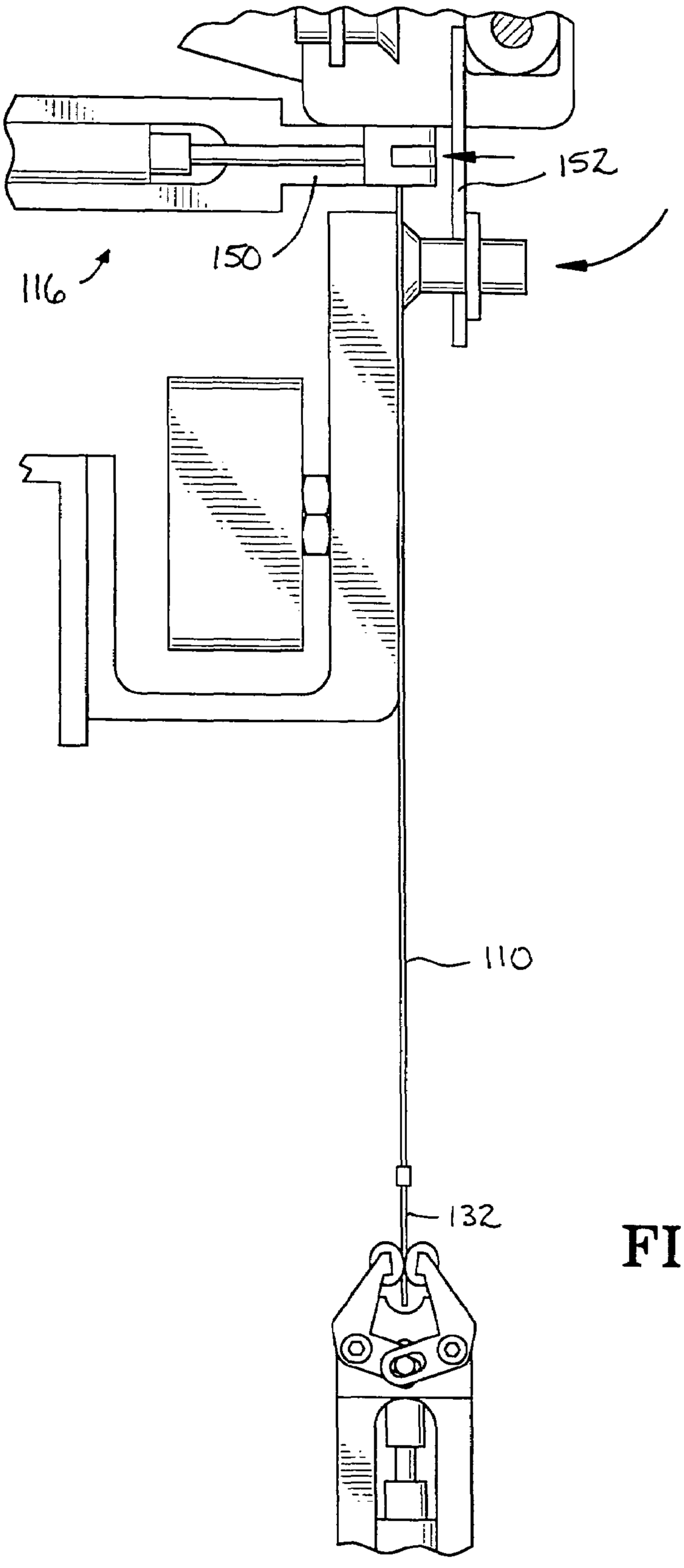

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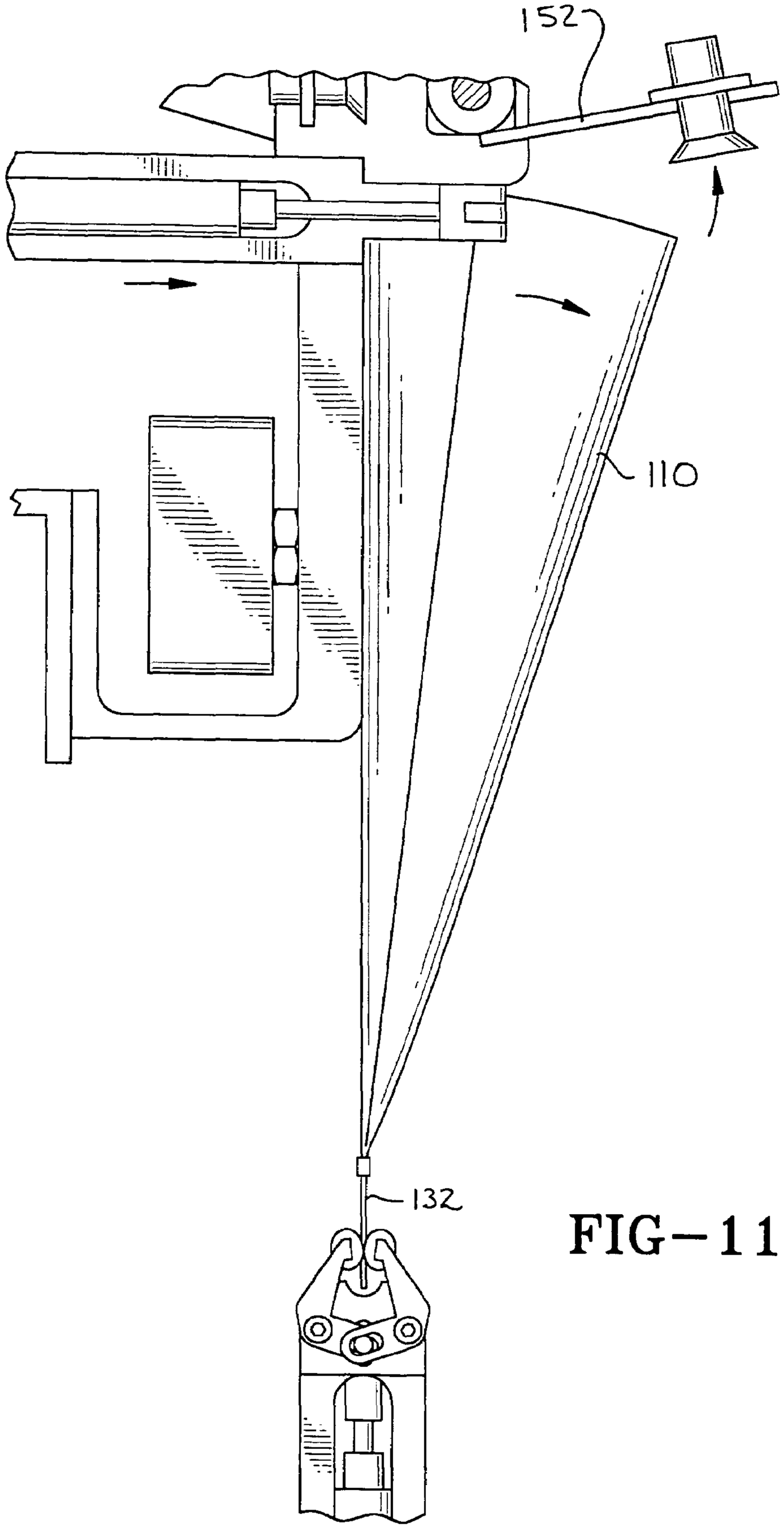

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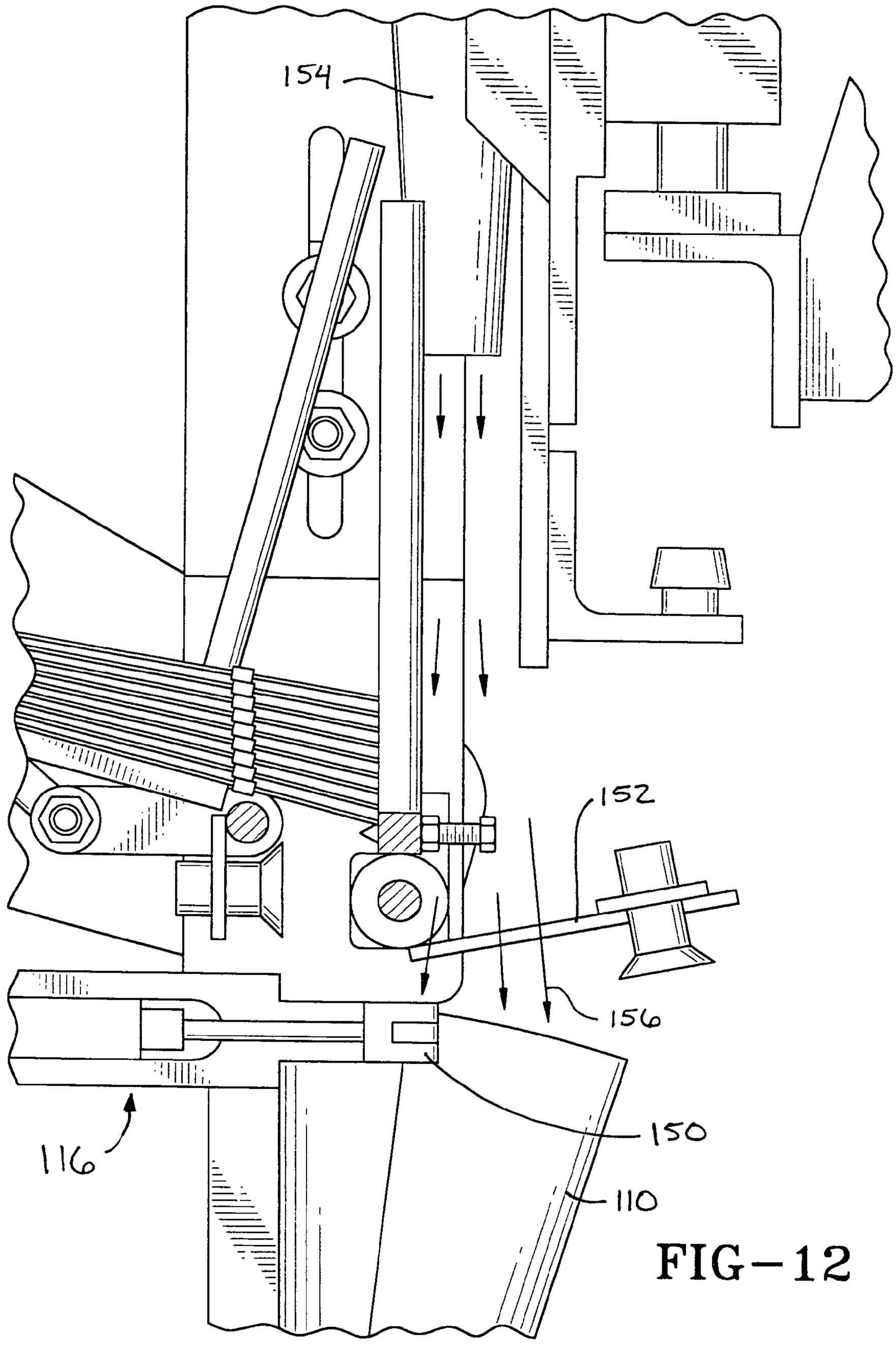

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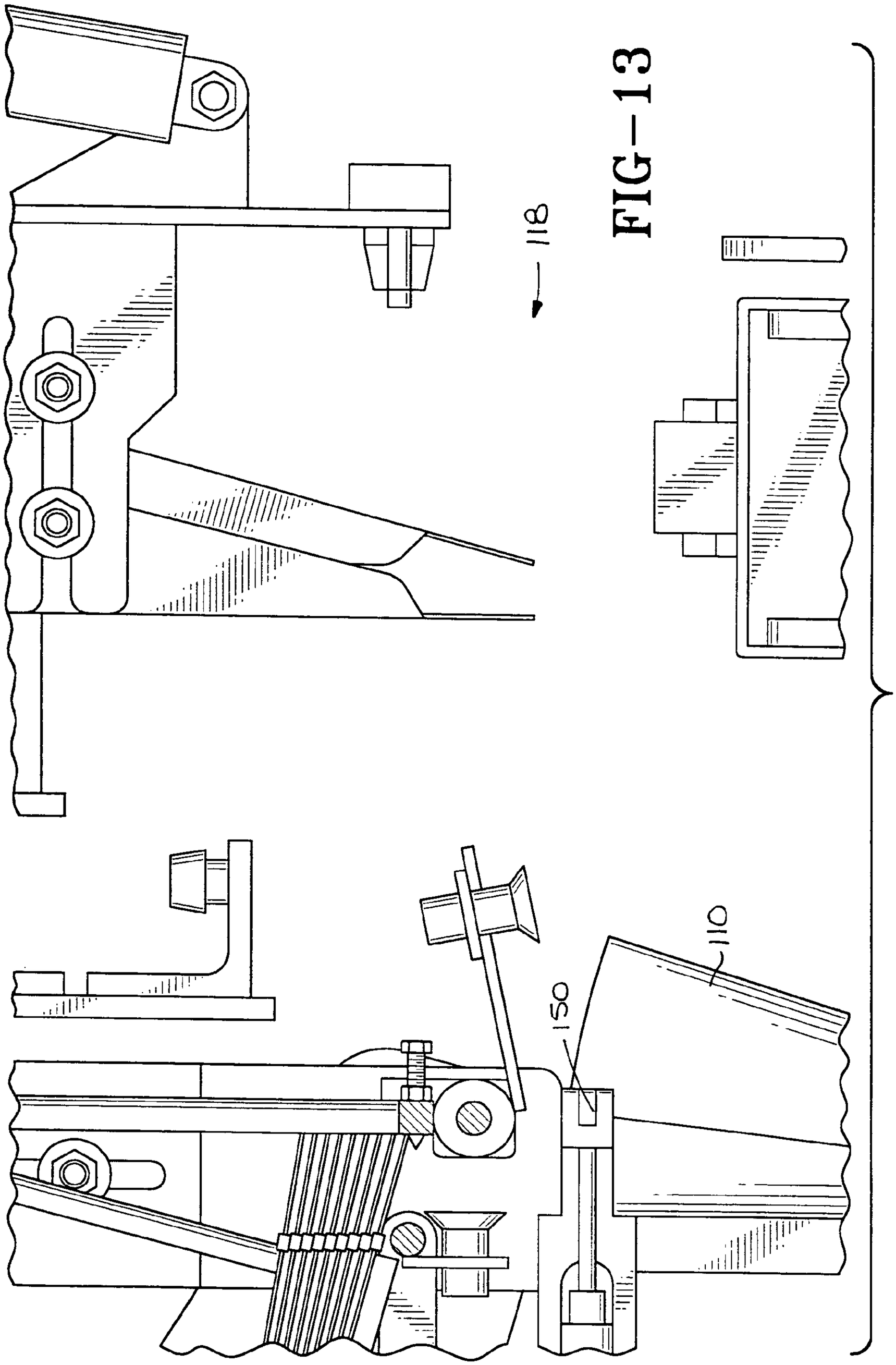
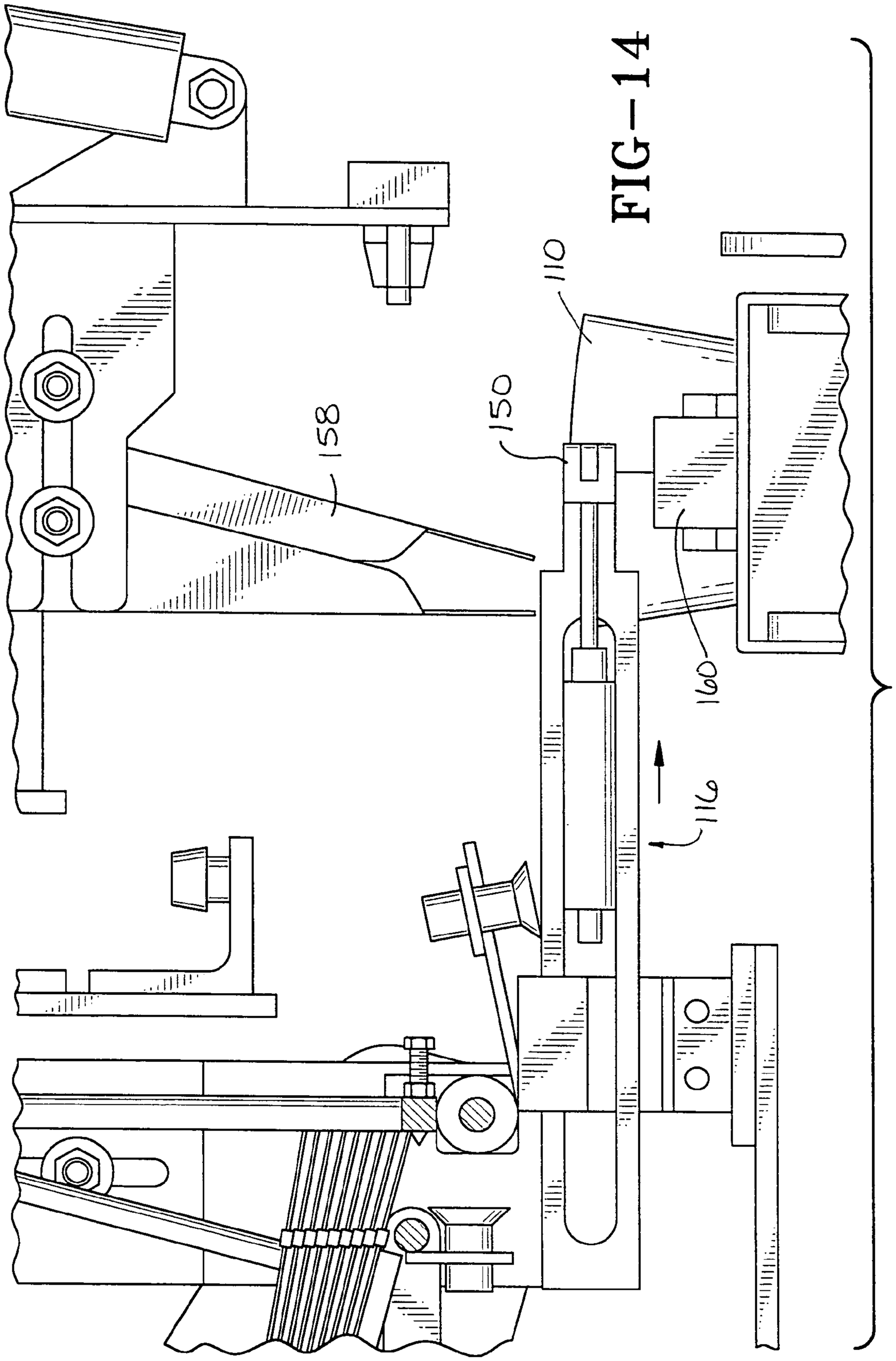


FIG-13

FIG-14



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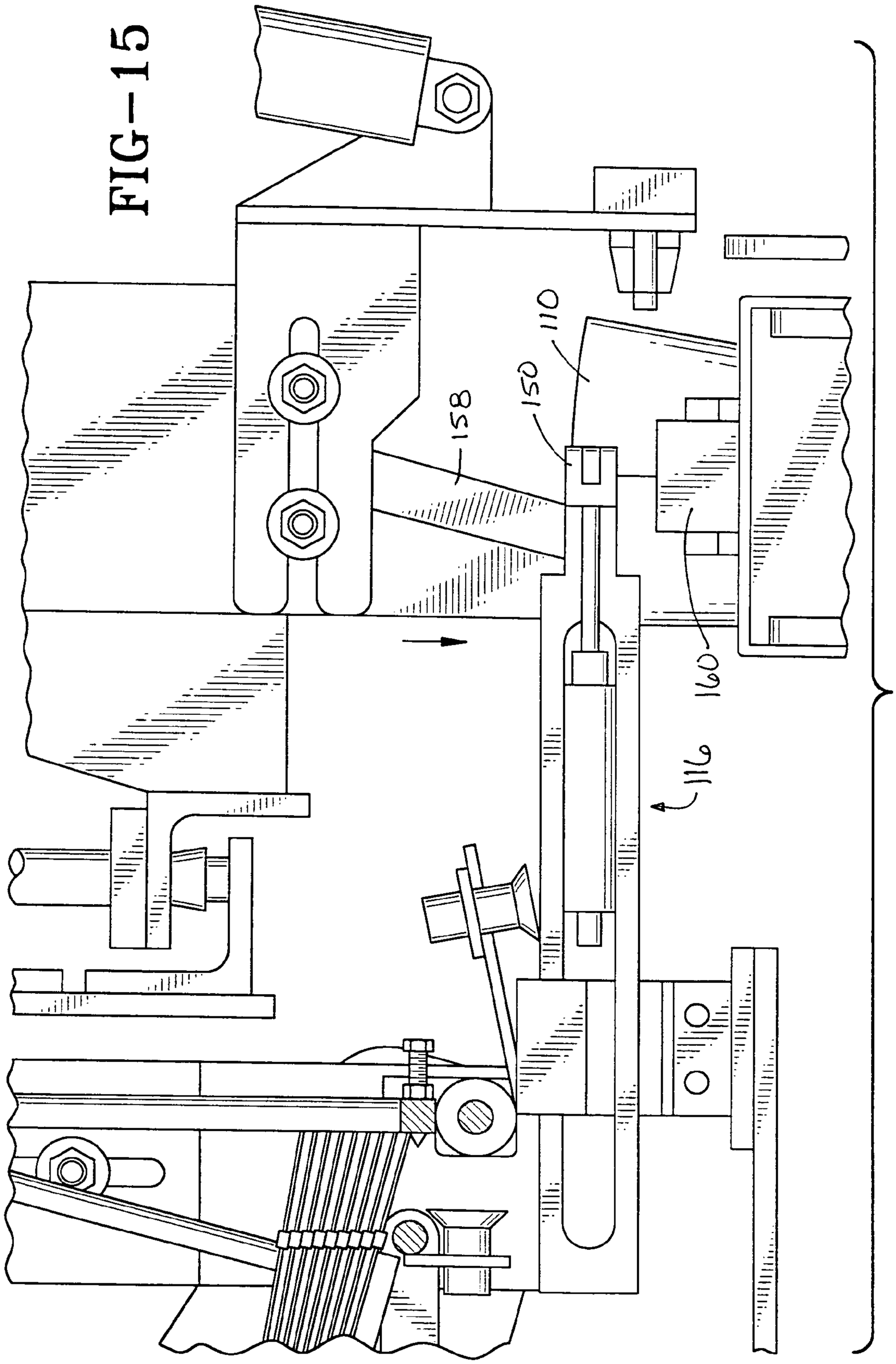

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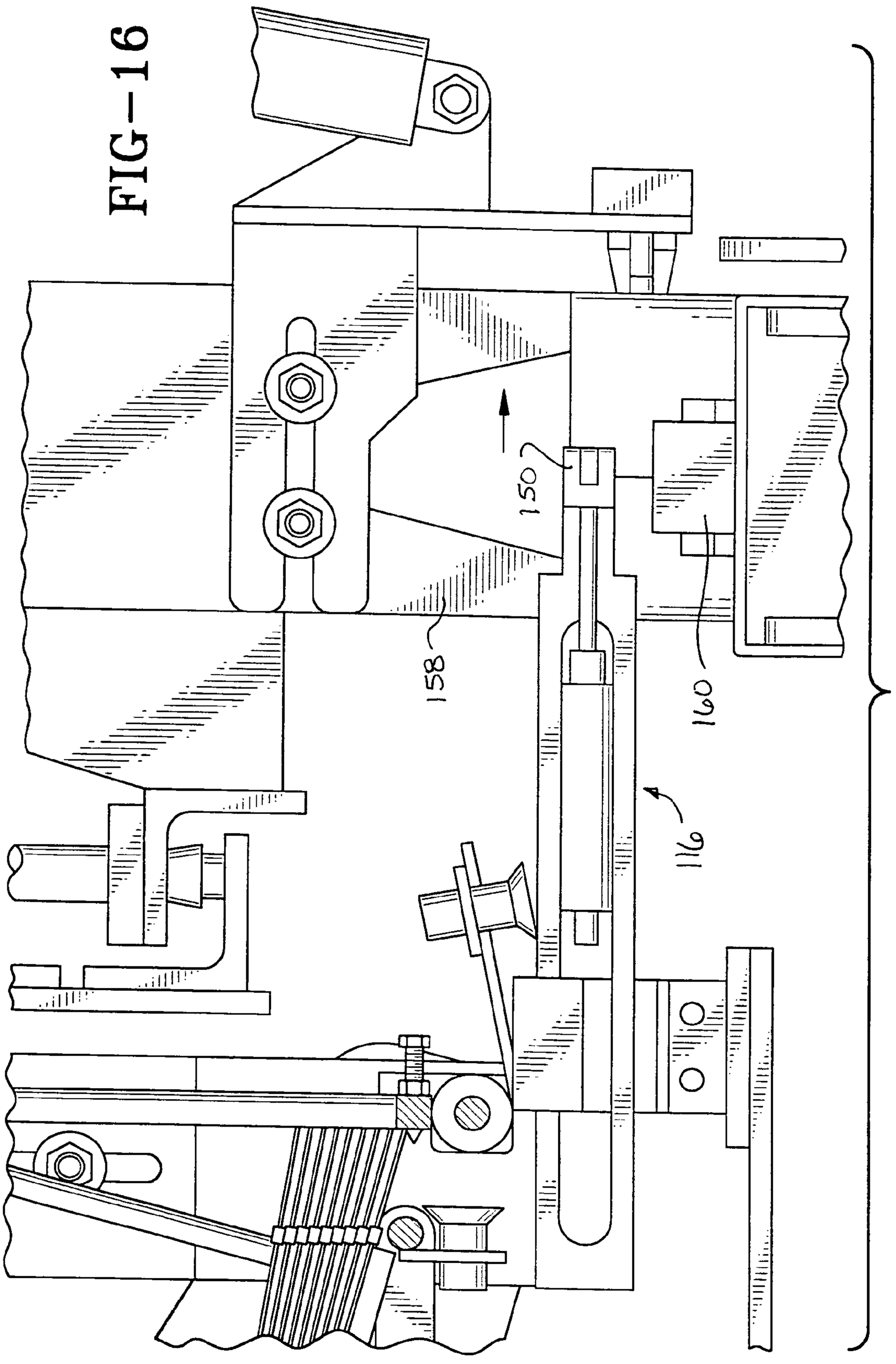

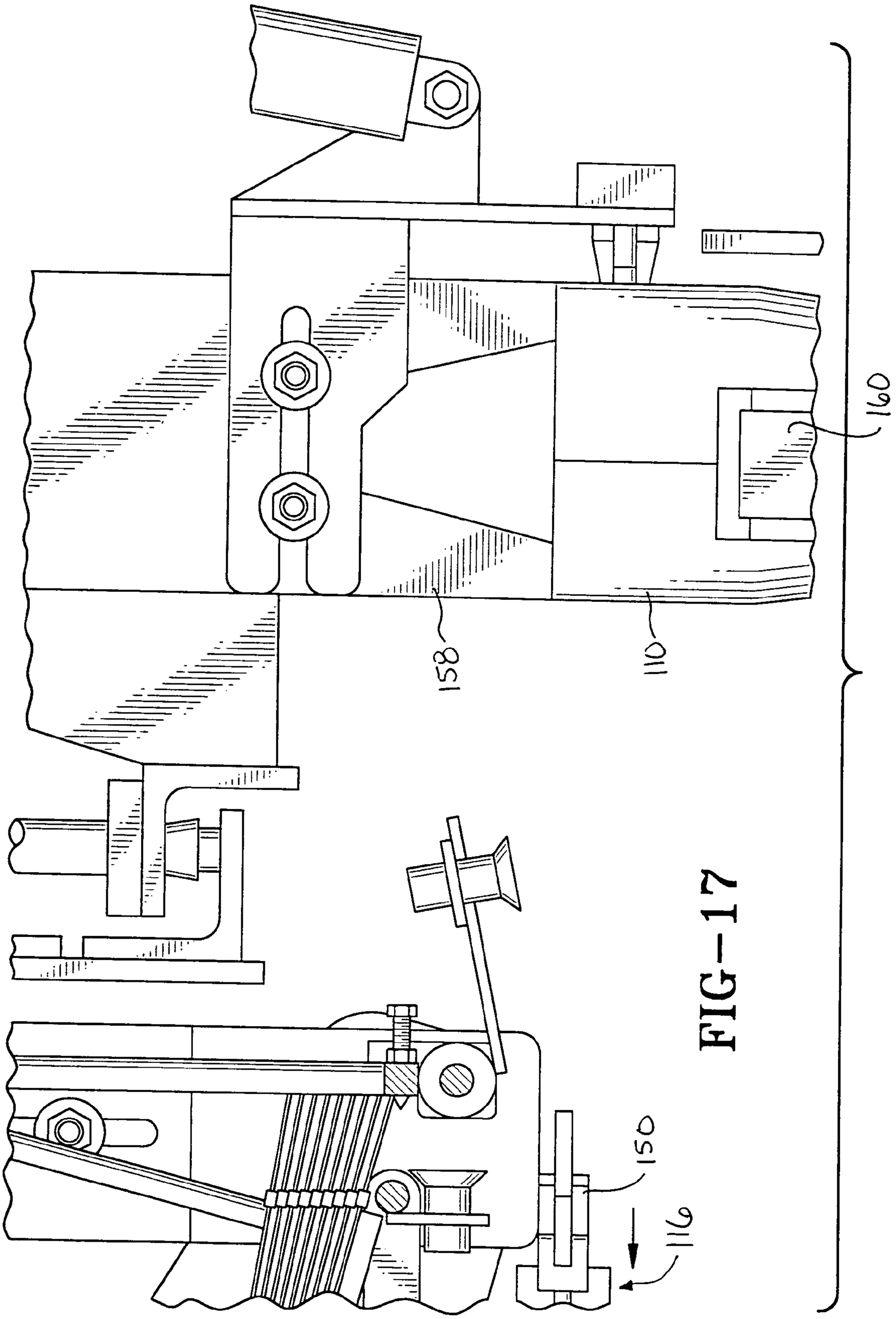

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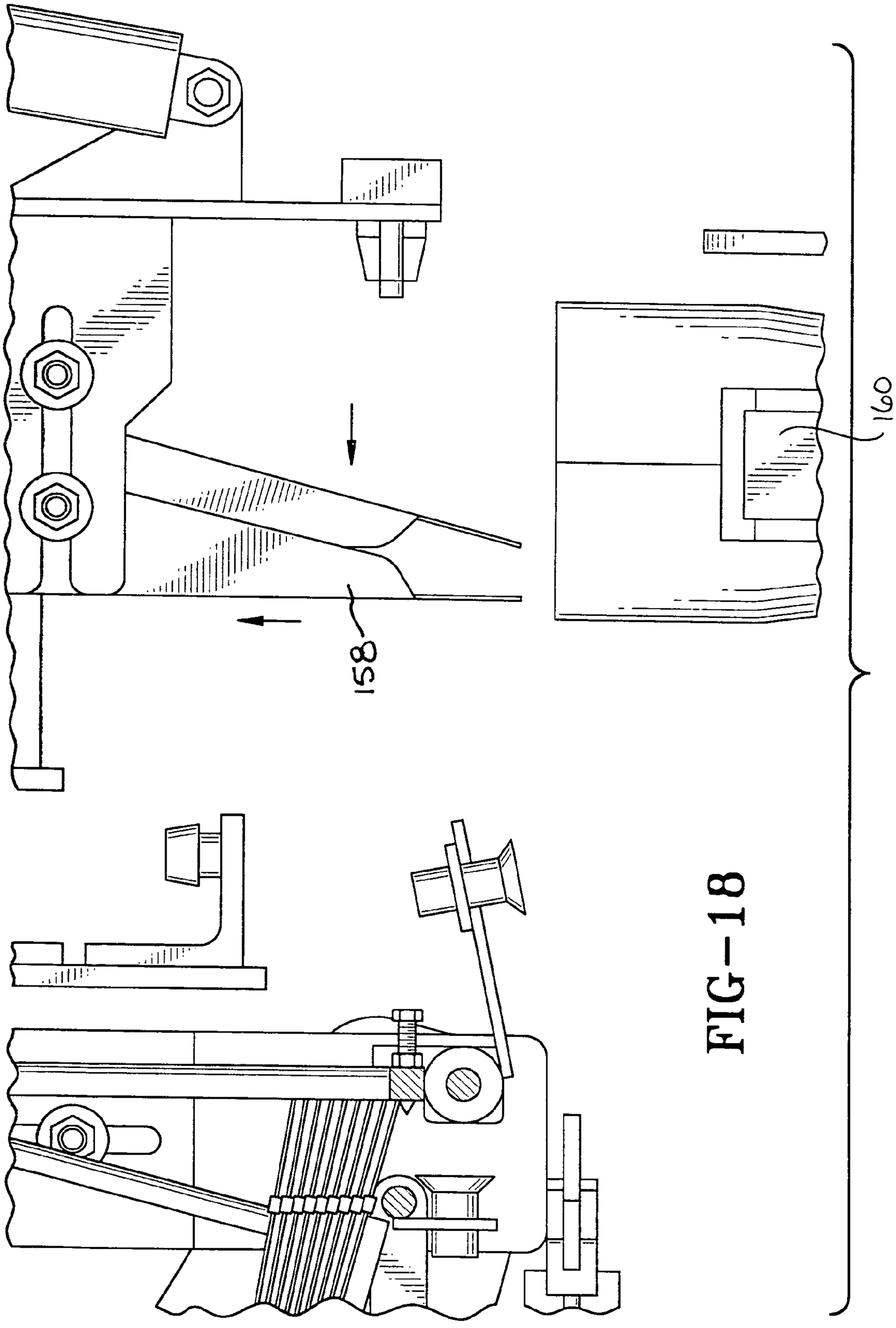

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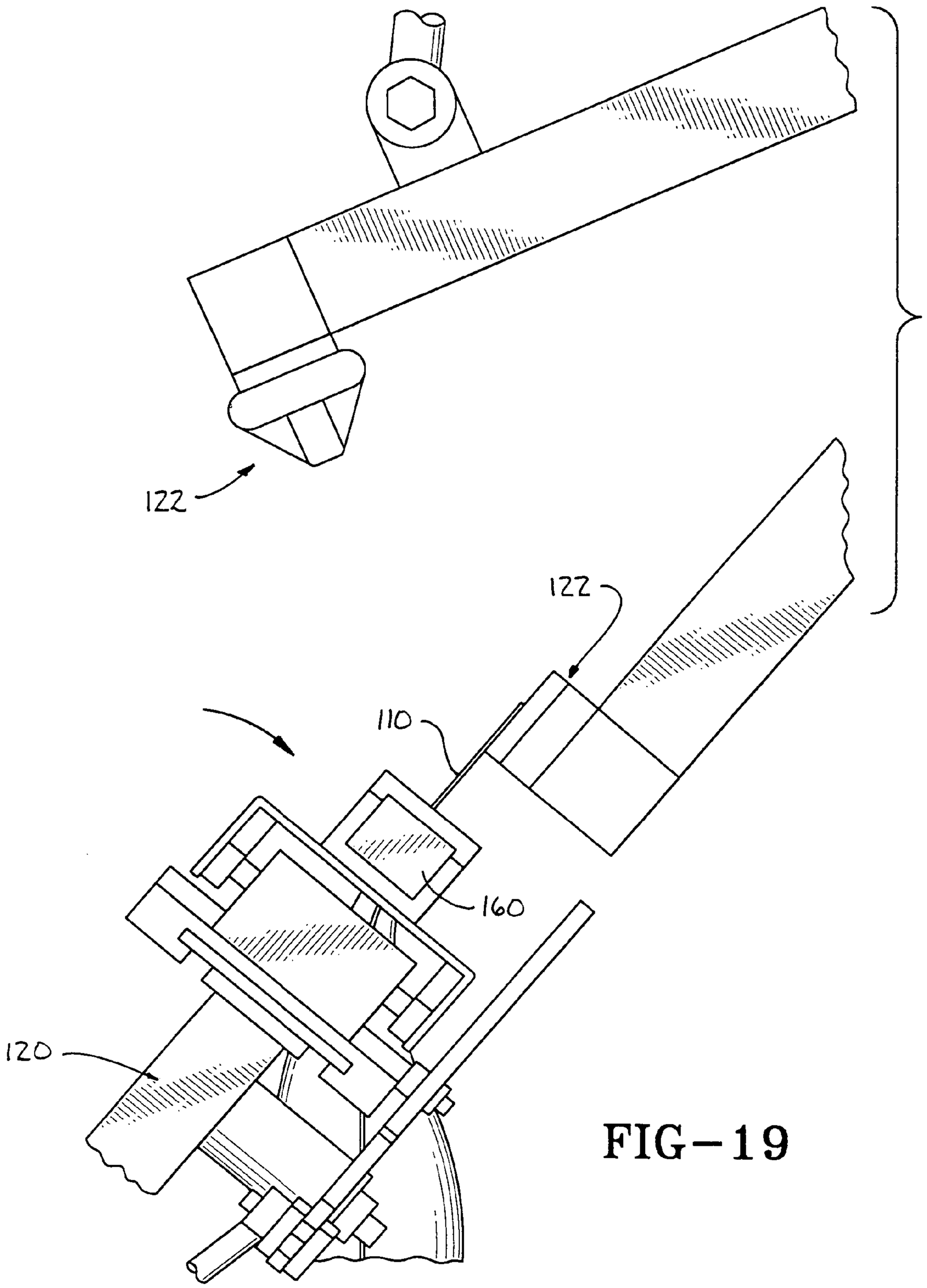

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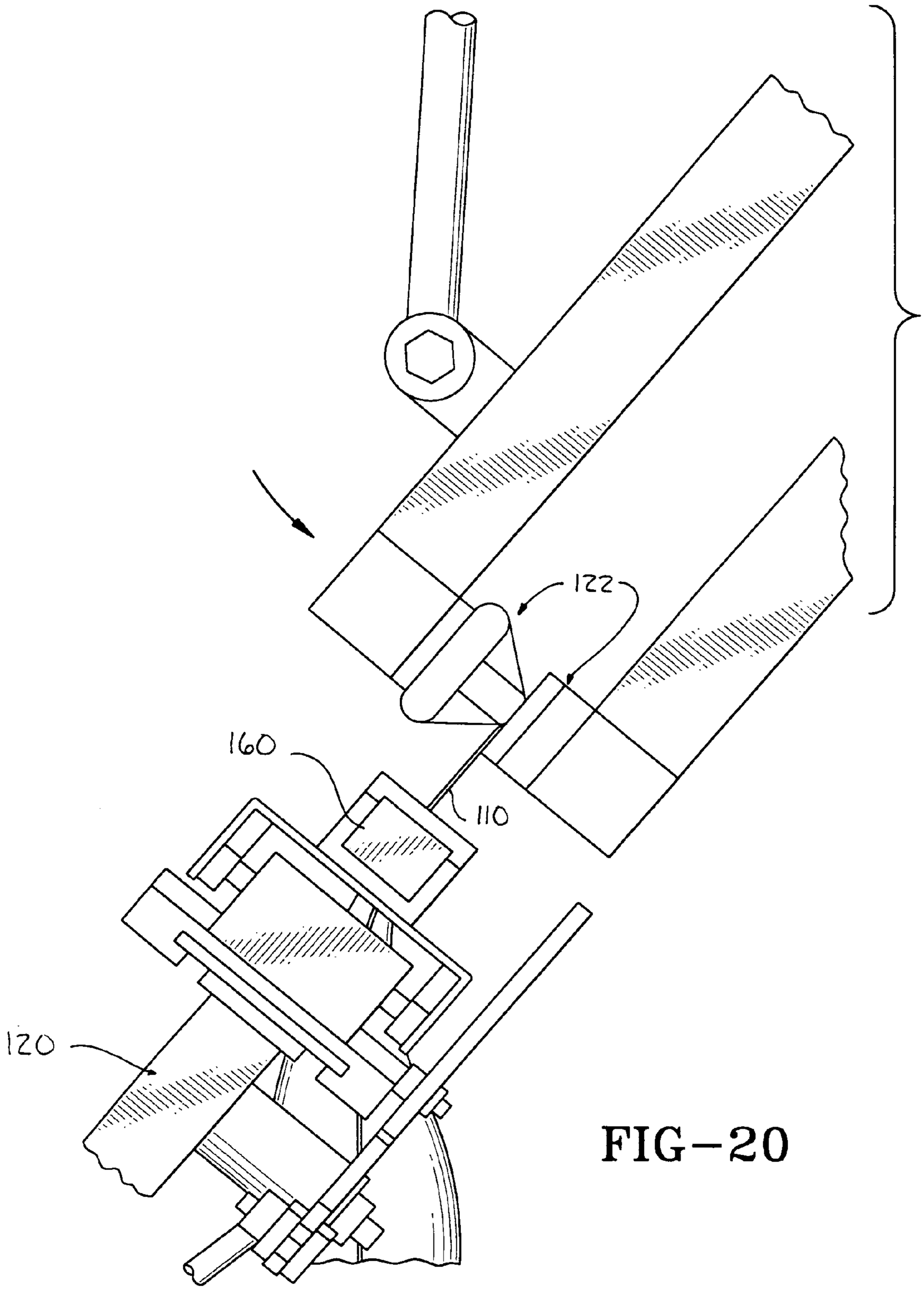
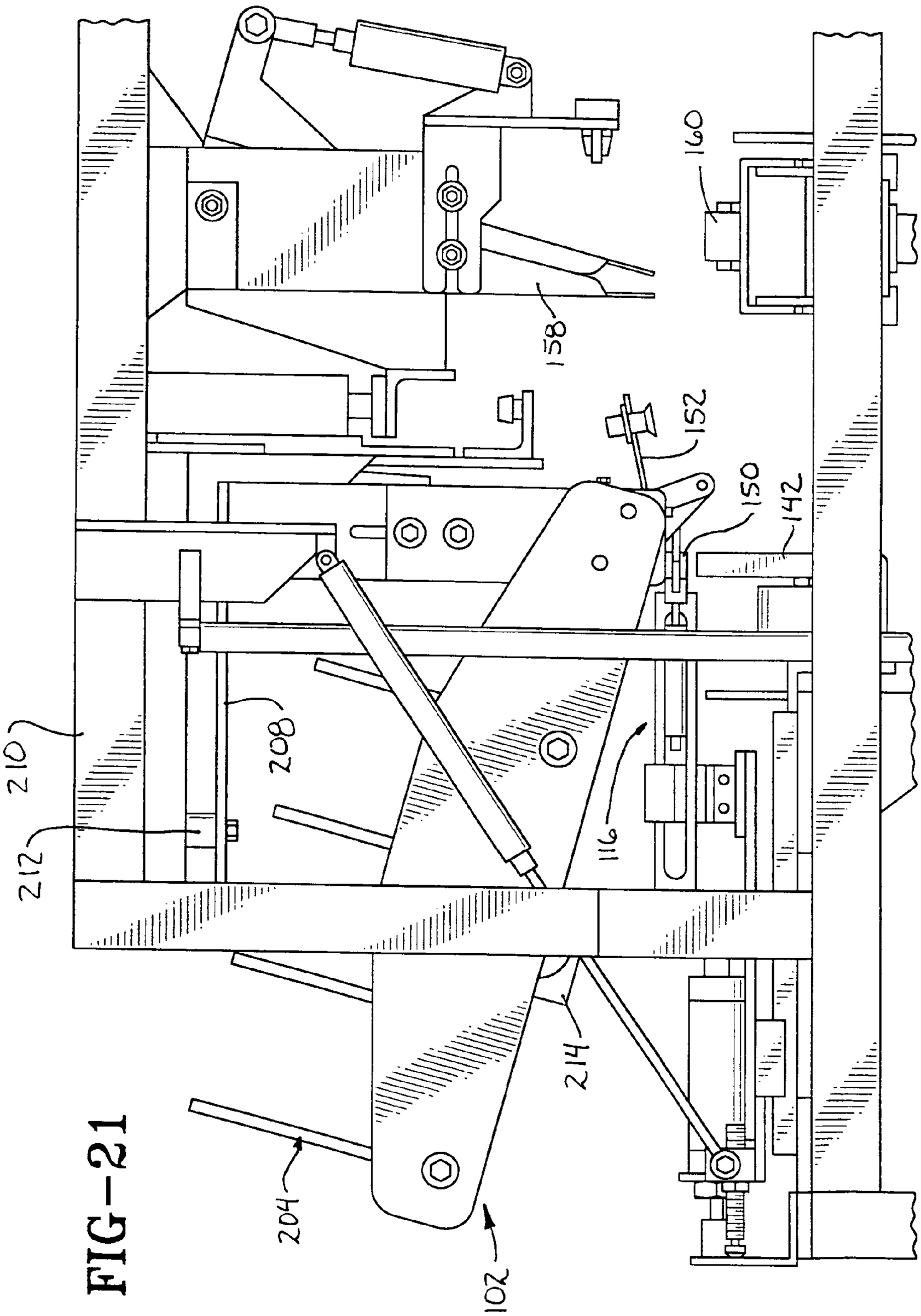


FIG–20



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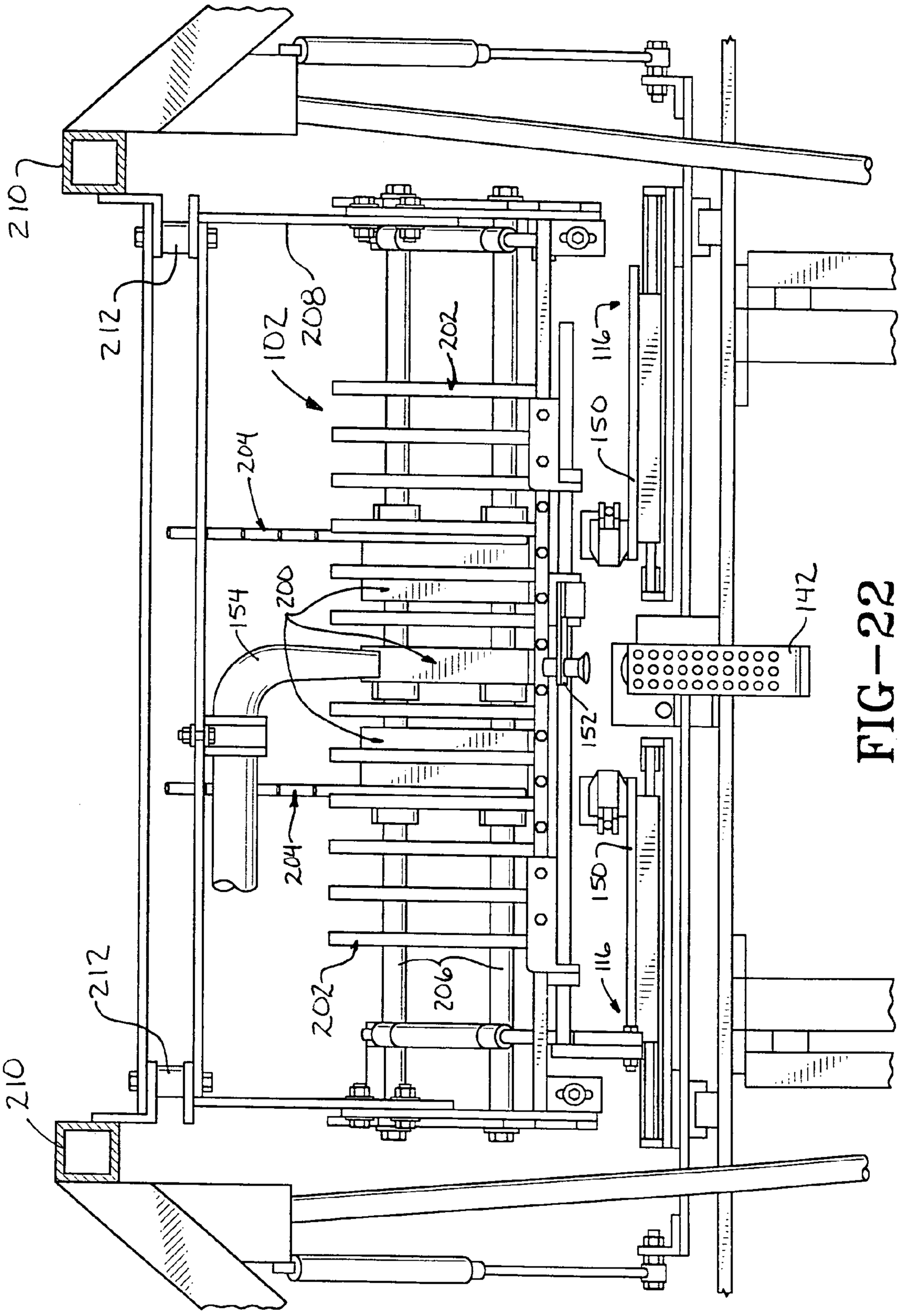
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FIG-22

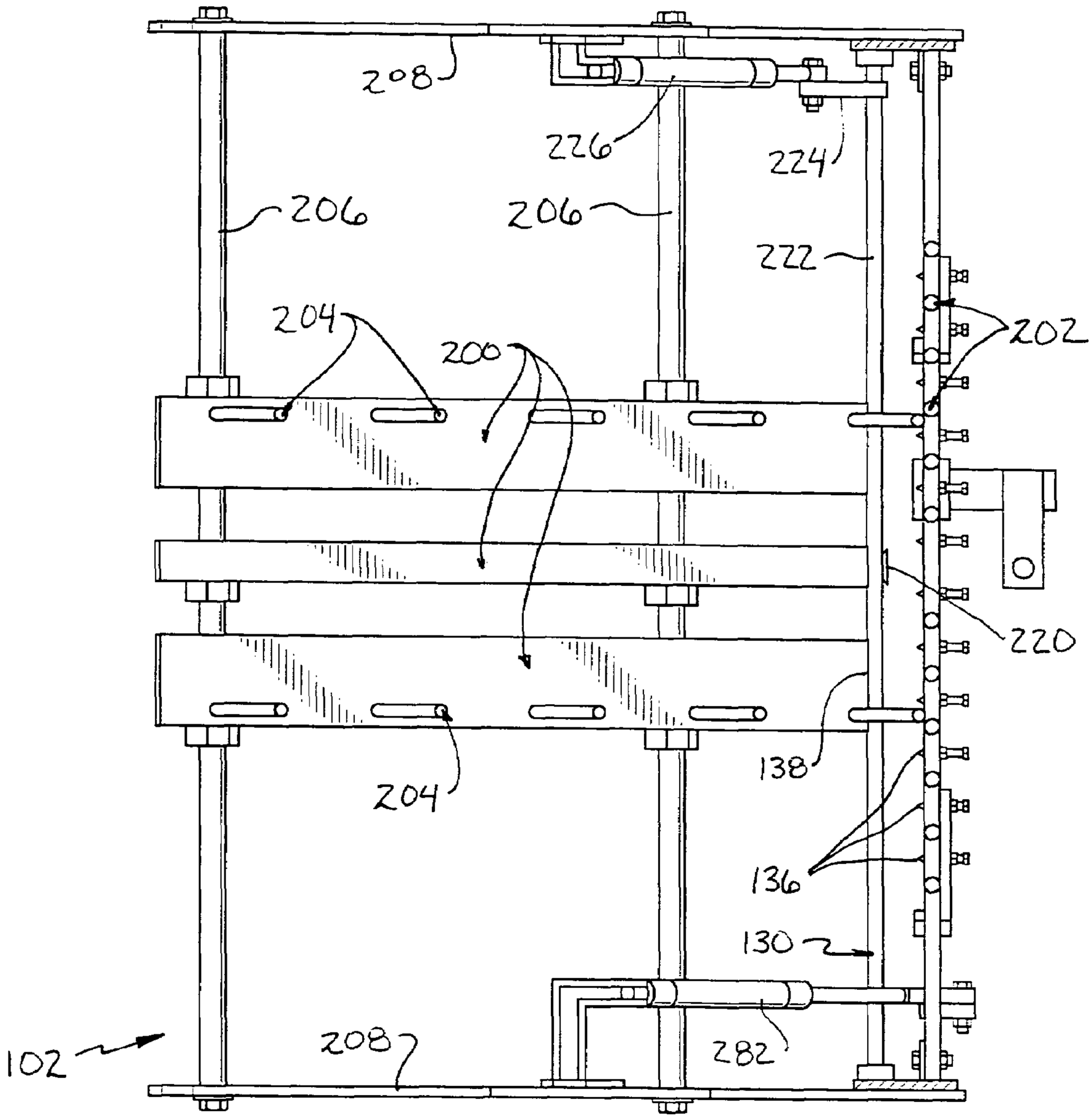
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FIG-23

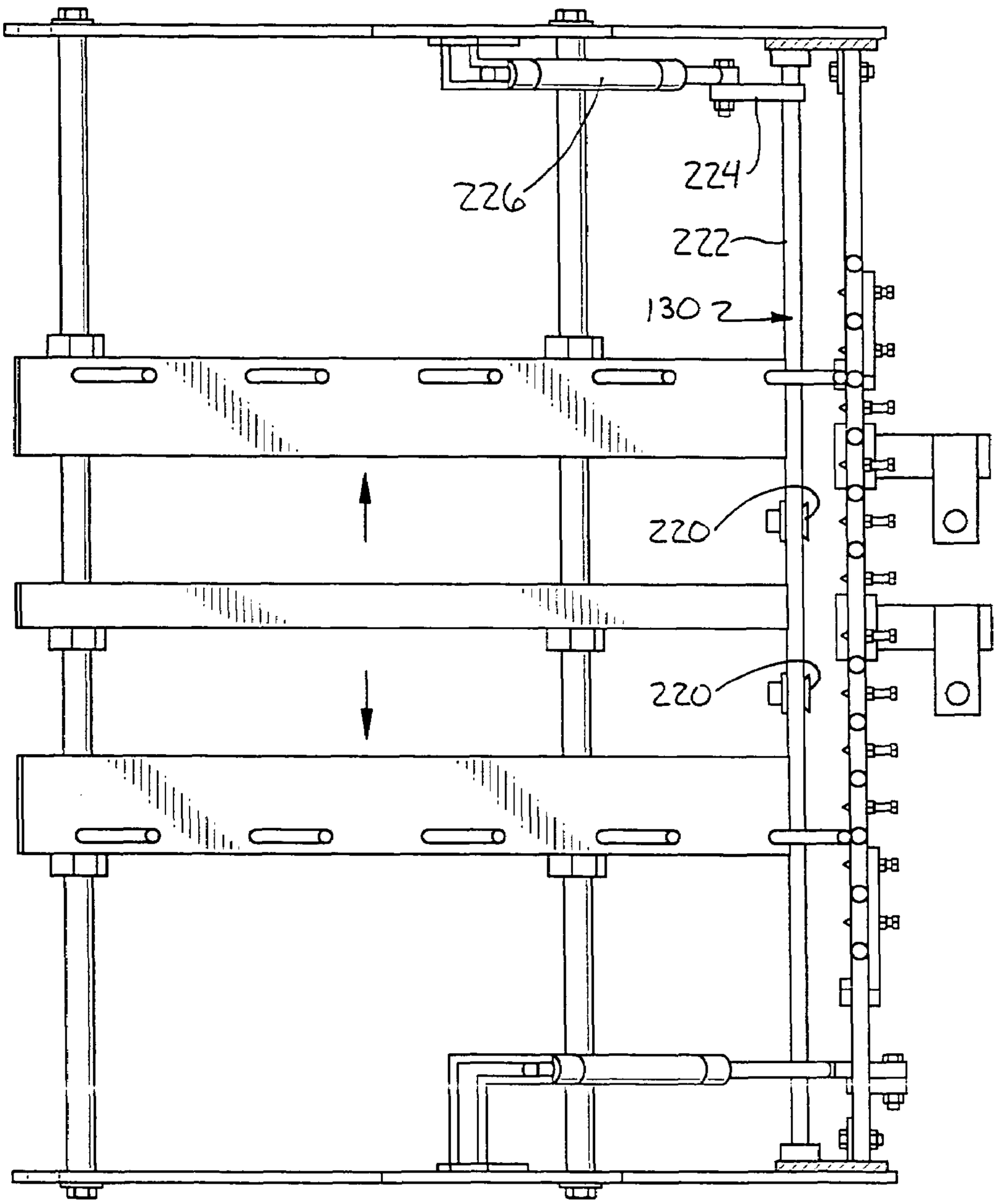
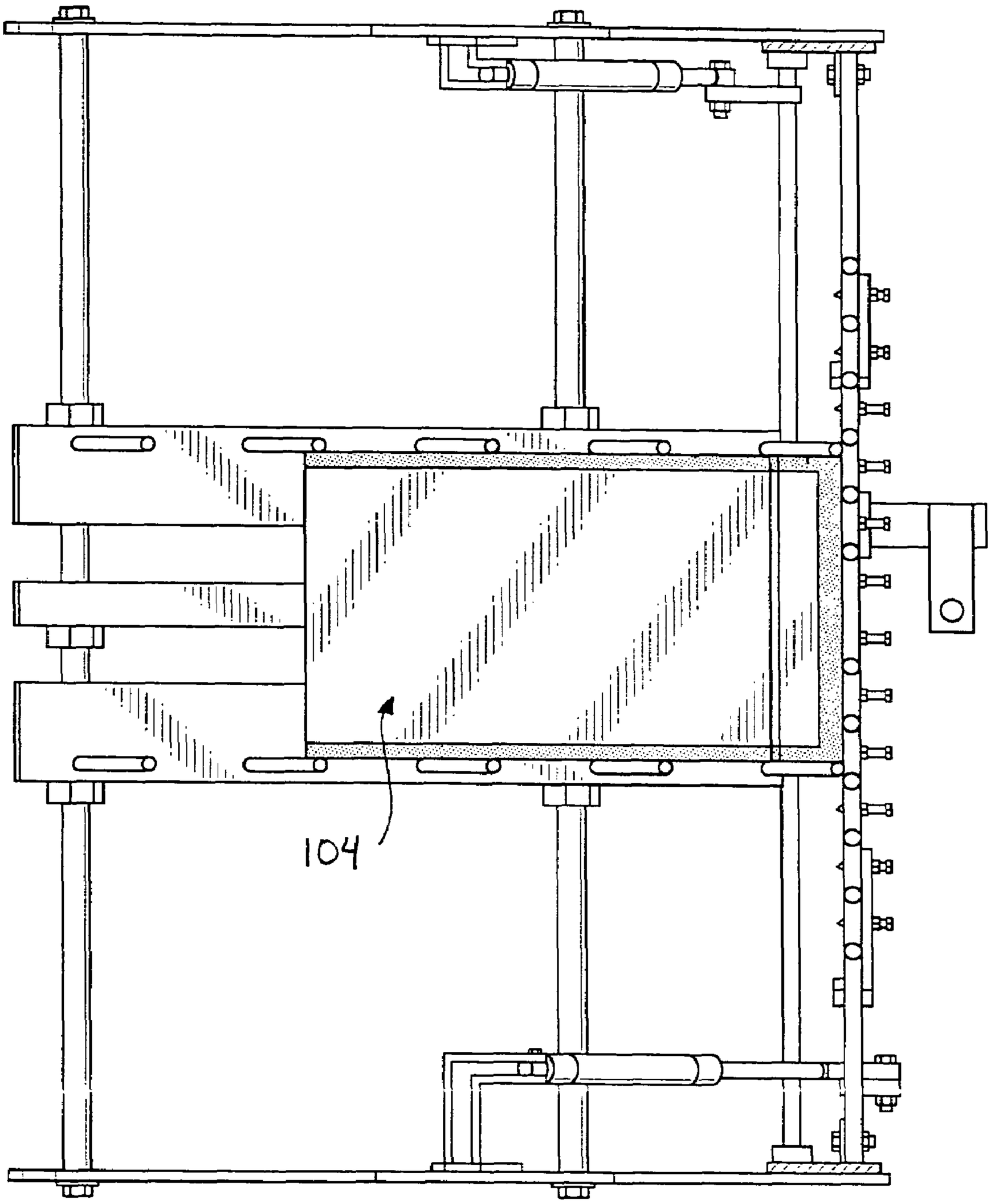


FIG-23A



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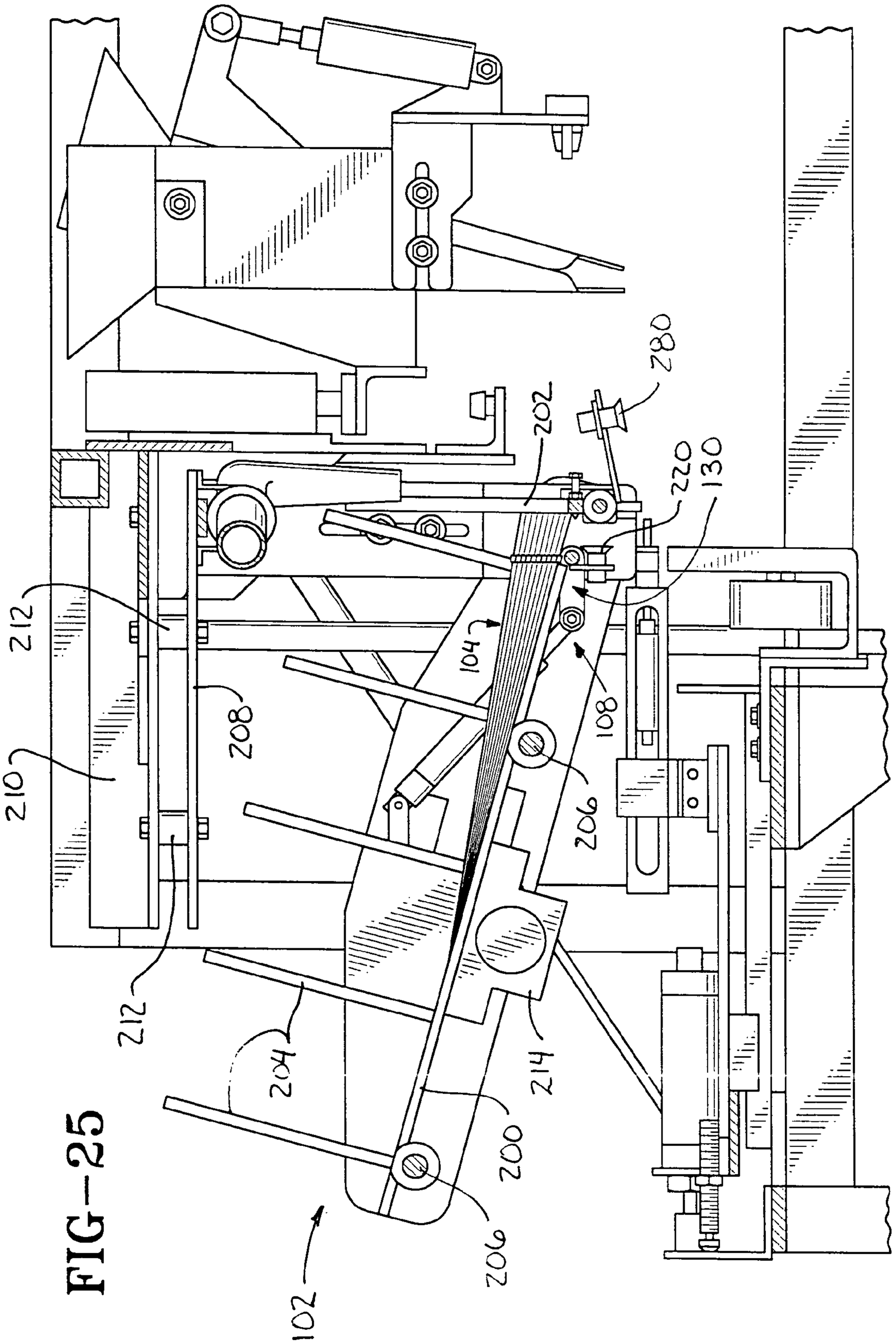
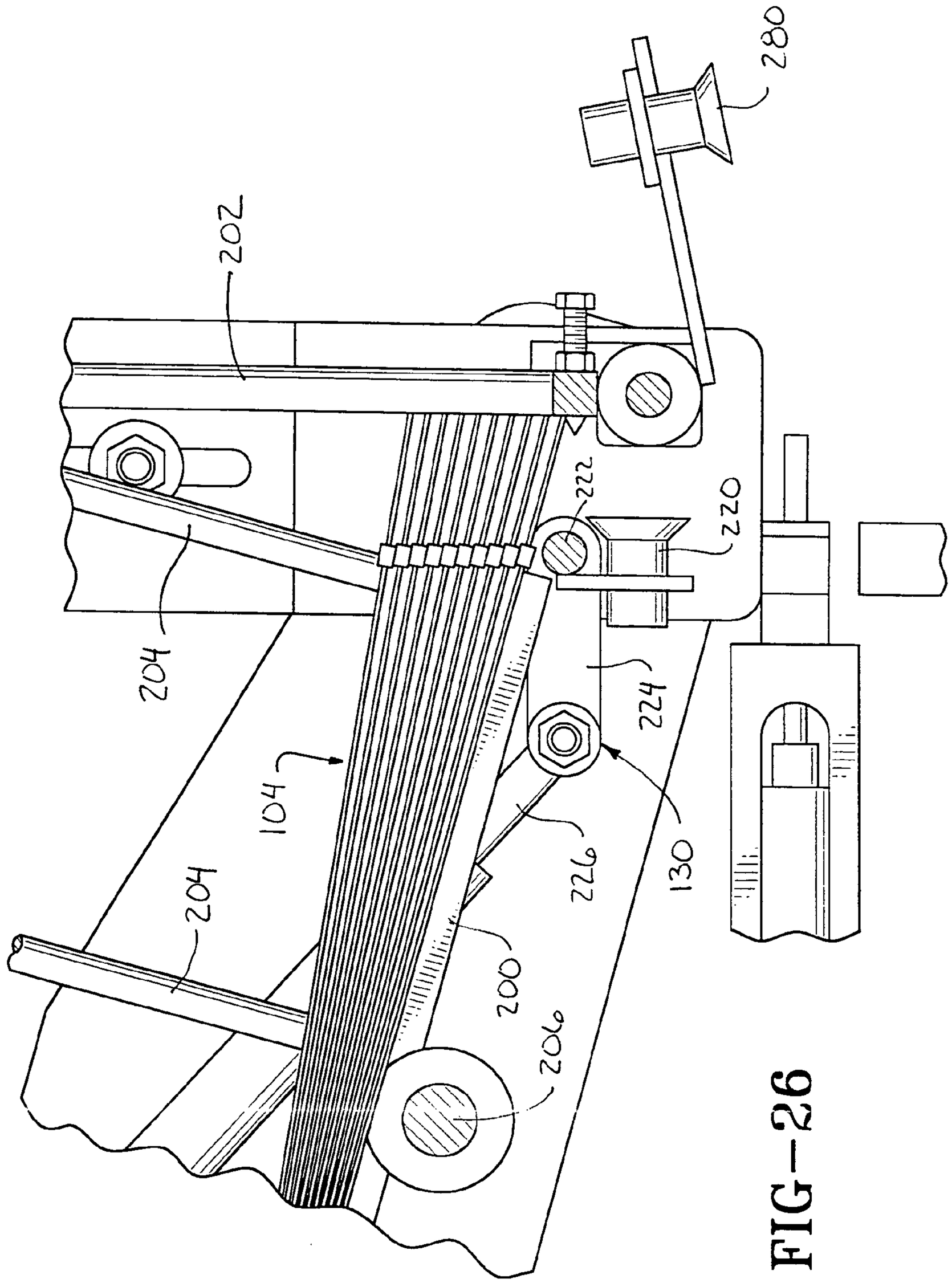


FIG-25



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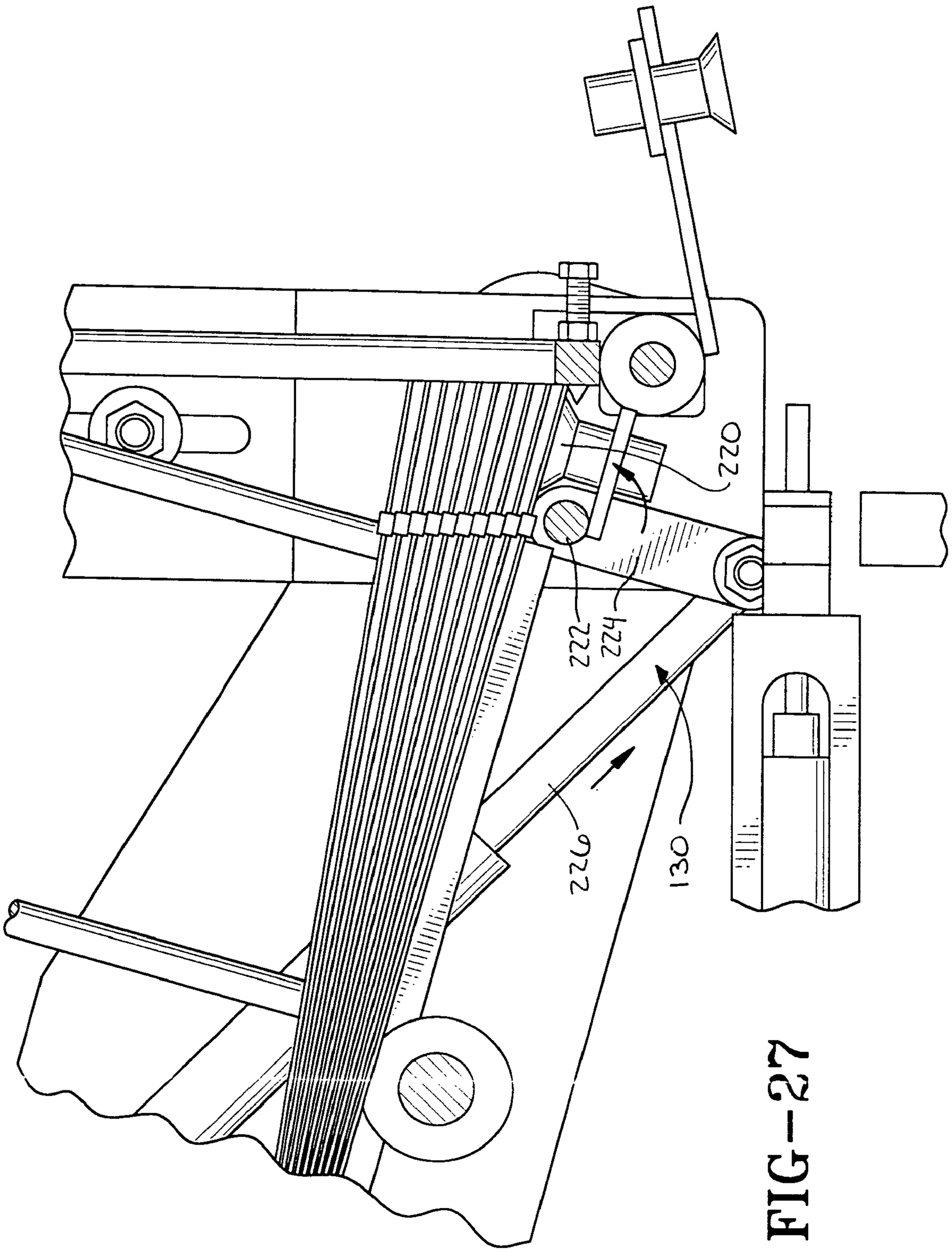

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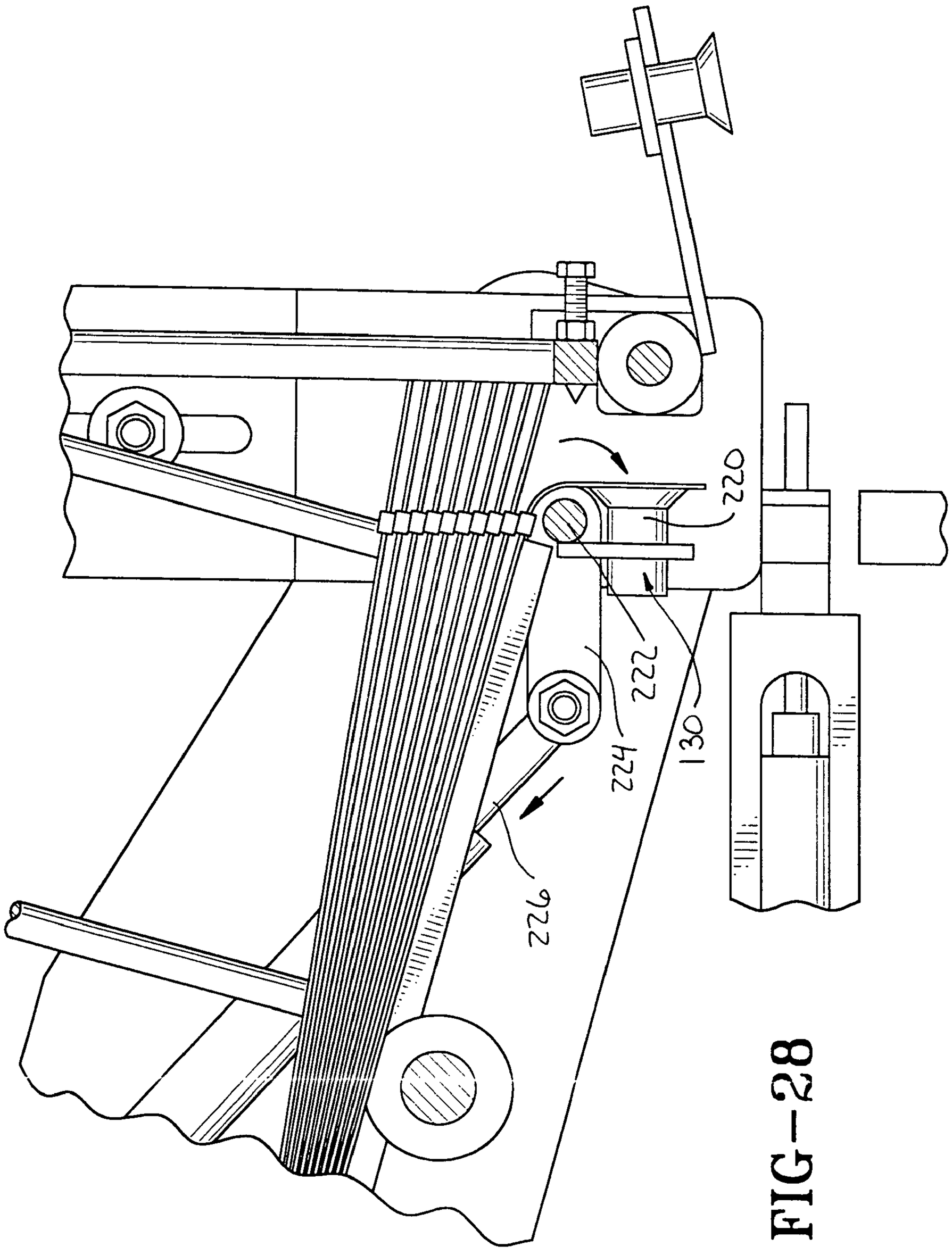

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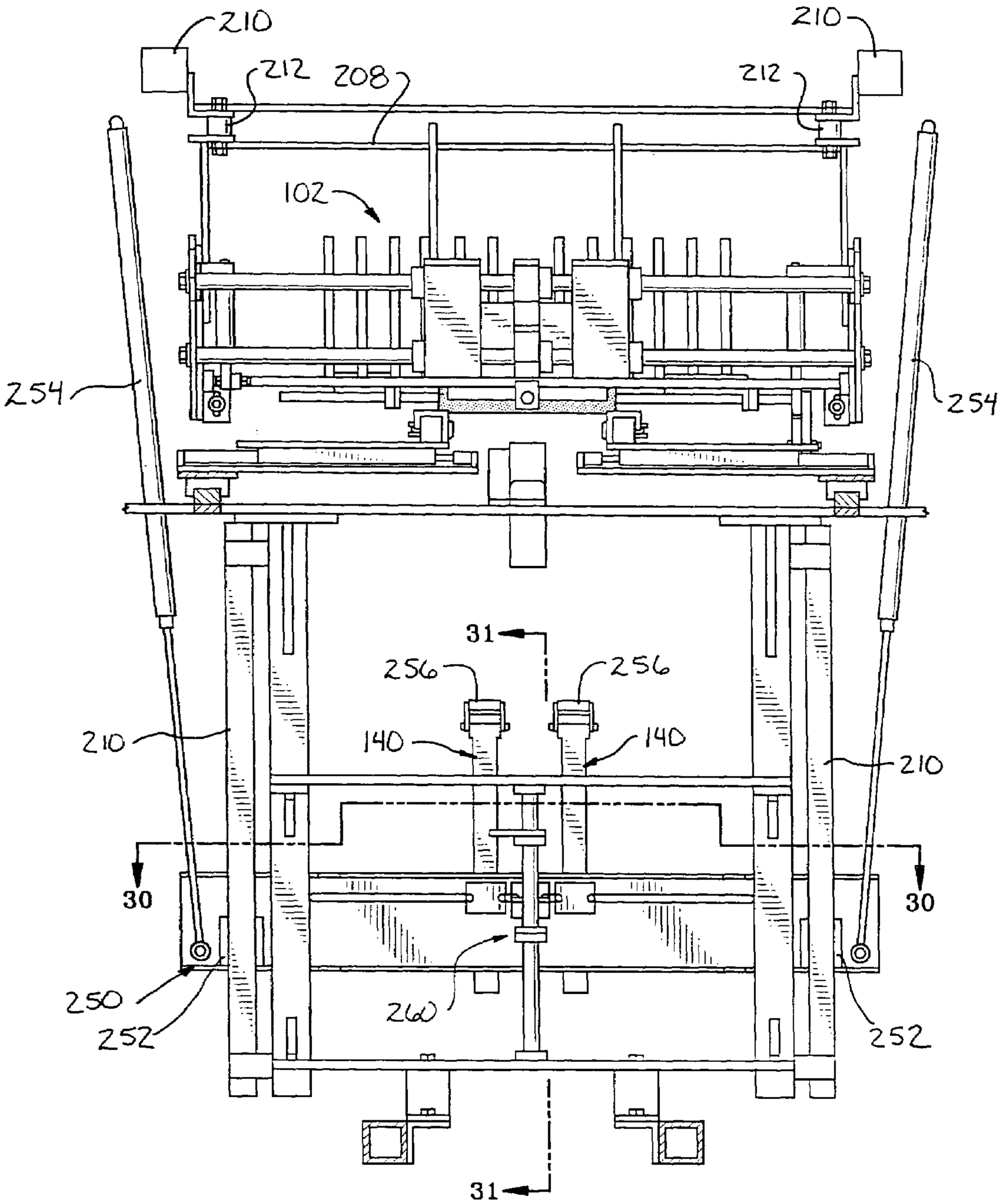
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FIG-29

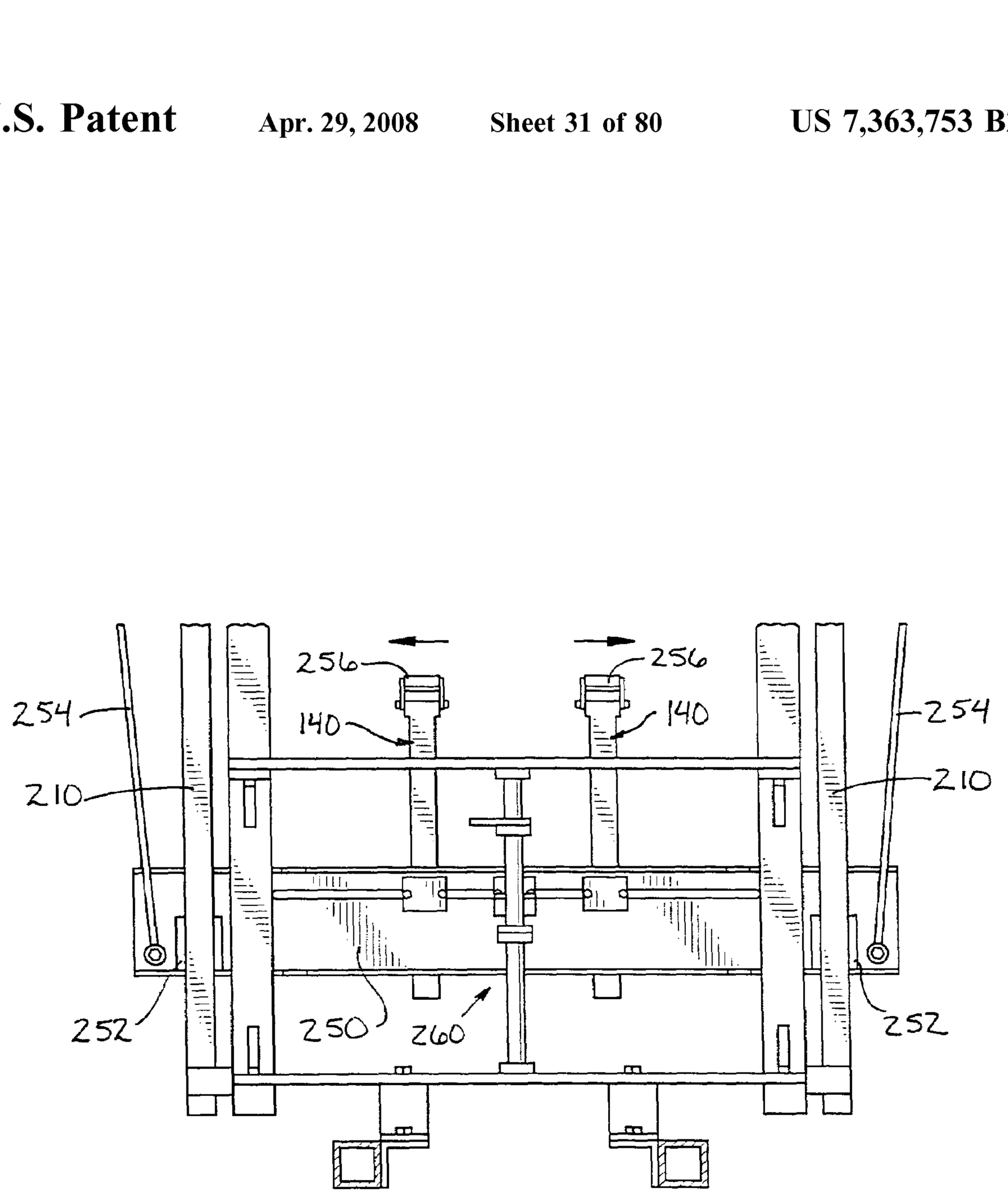


FIG-29A

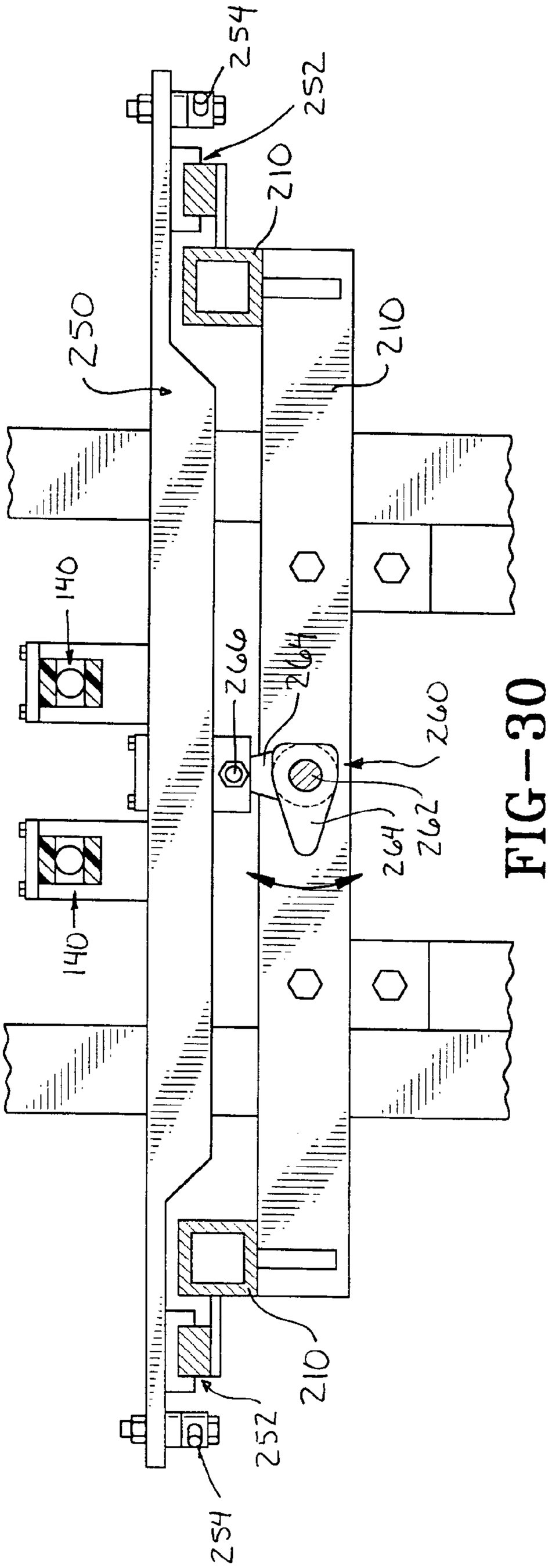
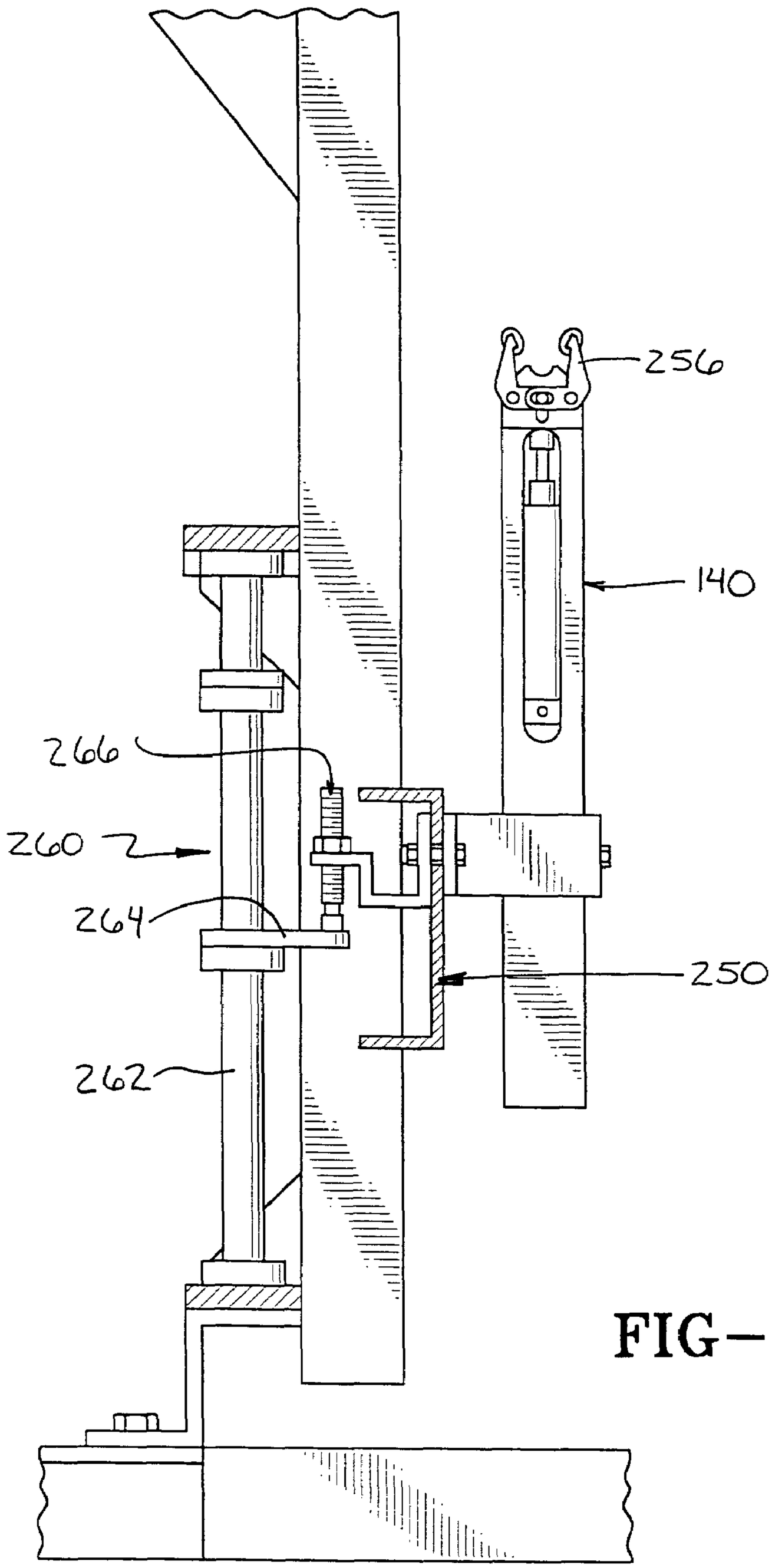


FIG-30



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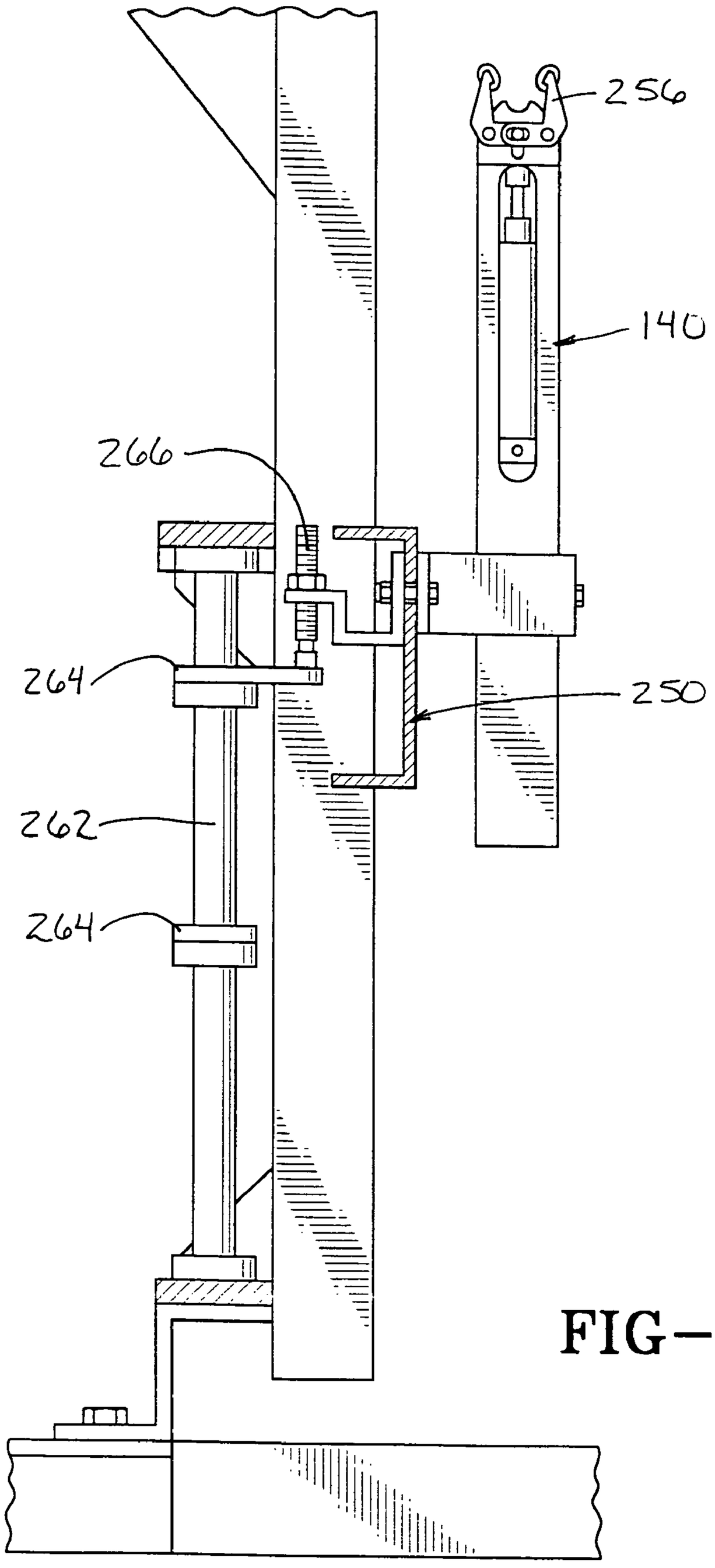
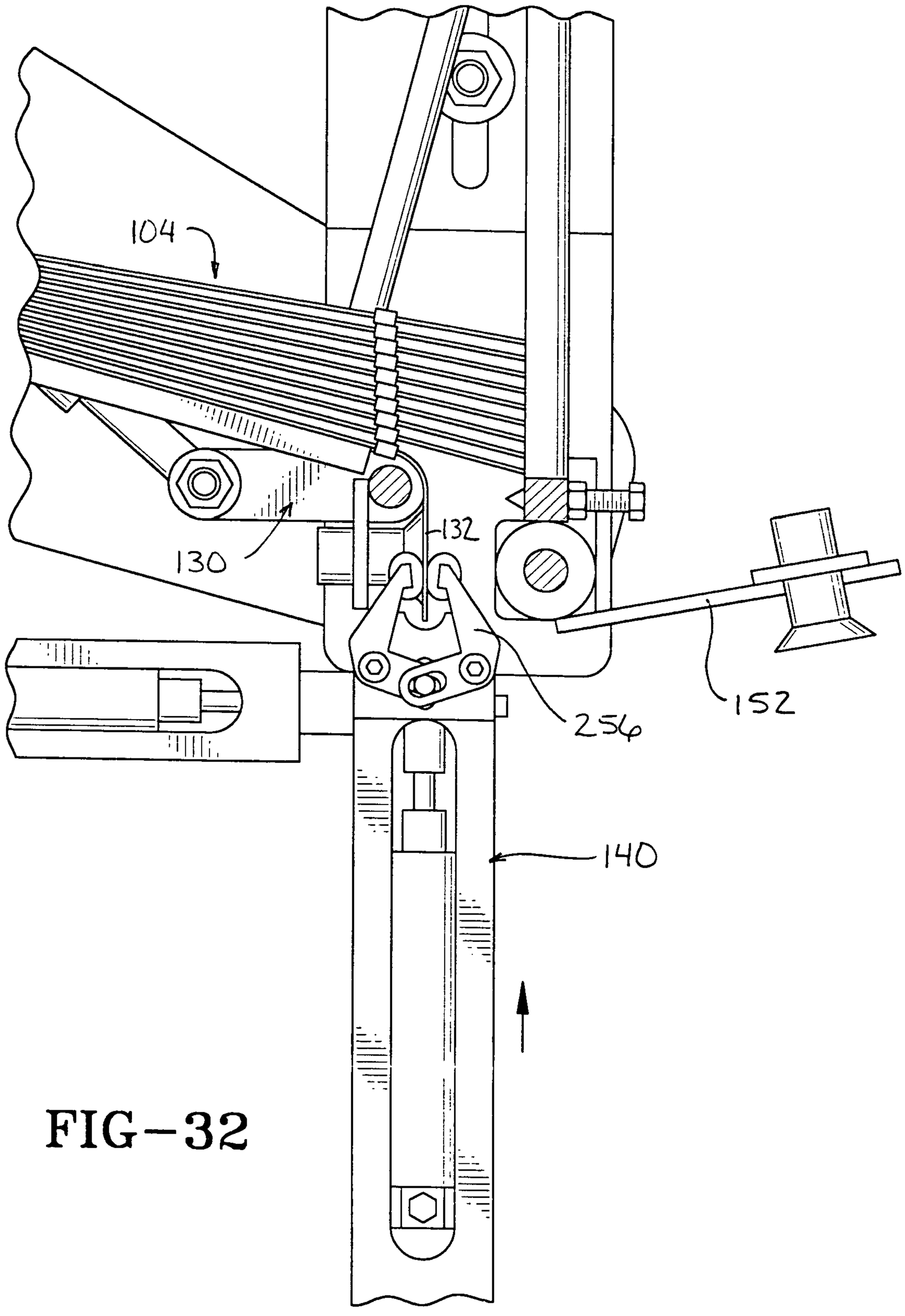


FIG-31A



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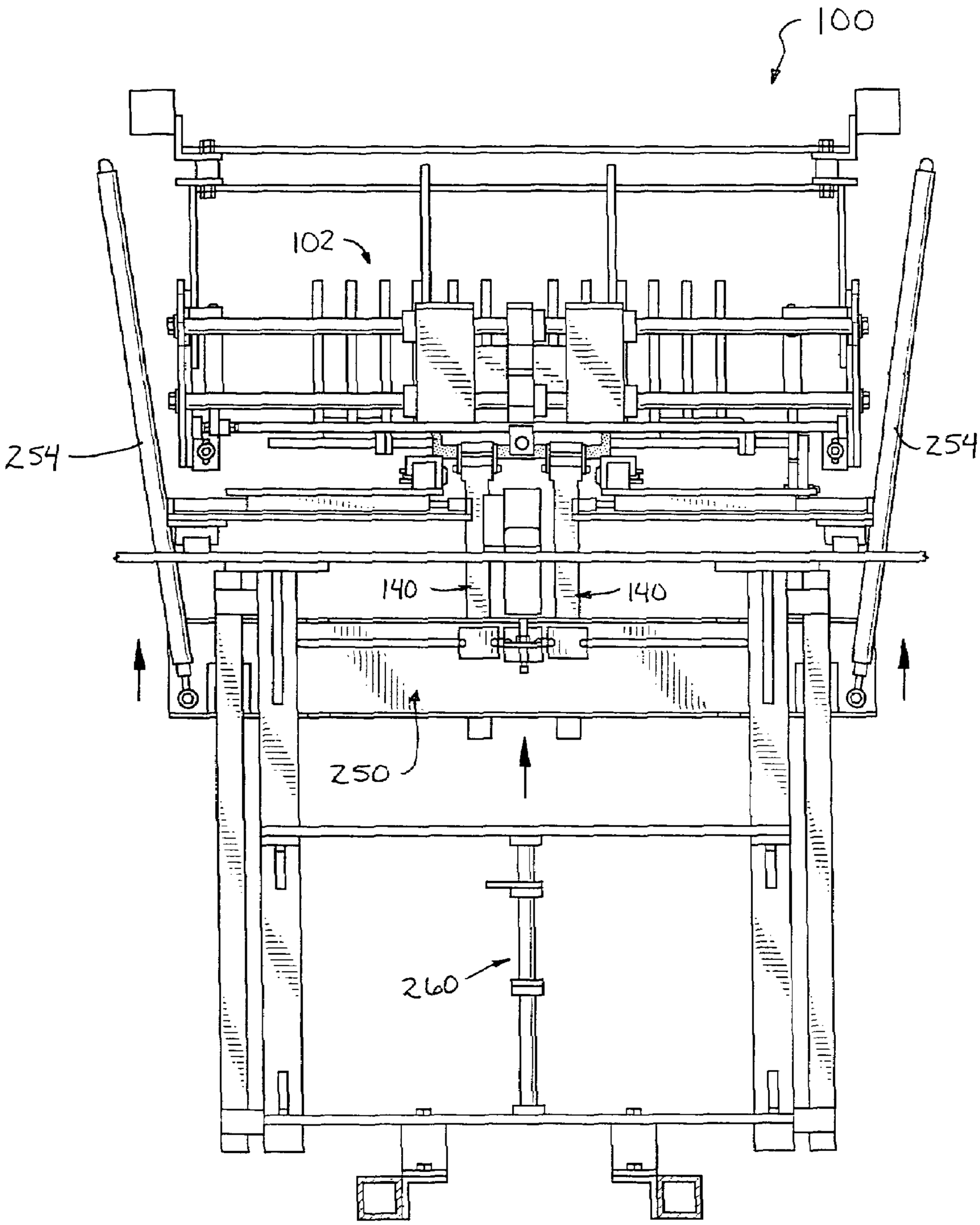

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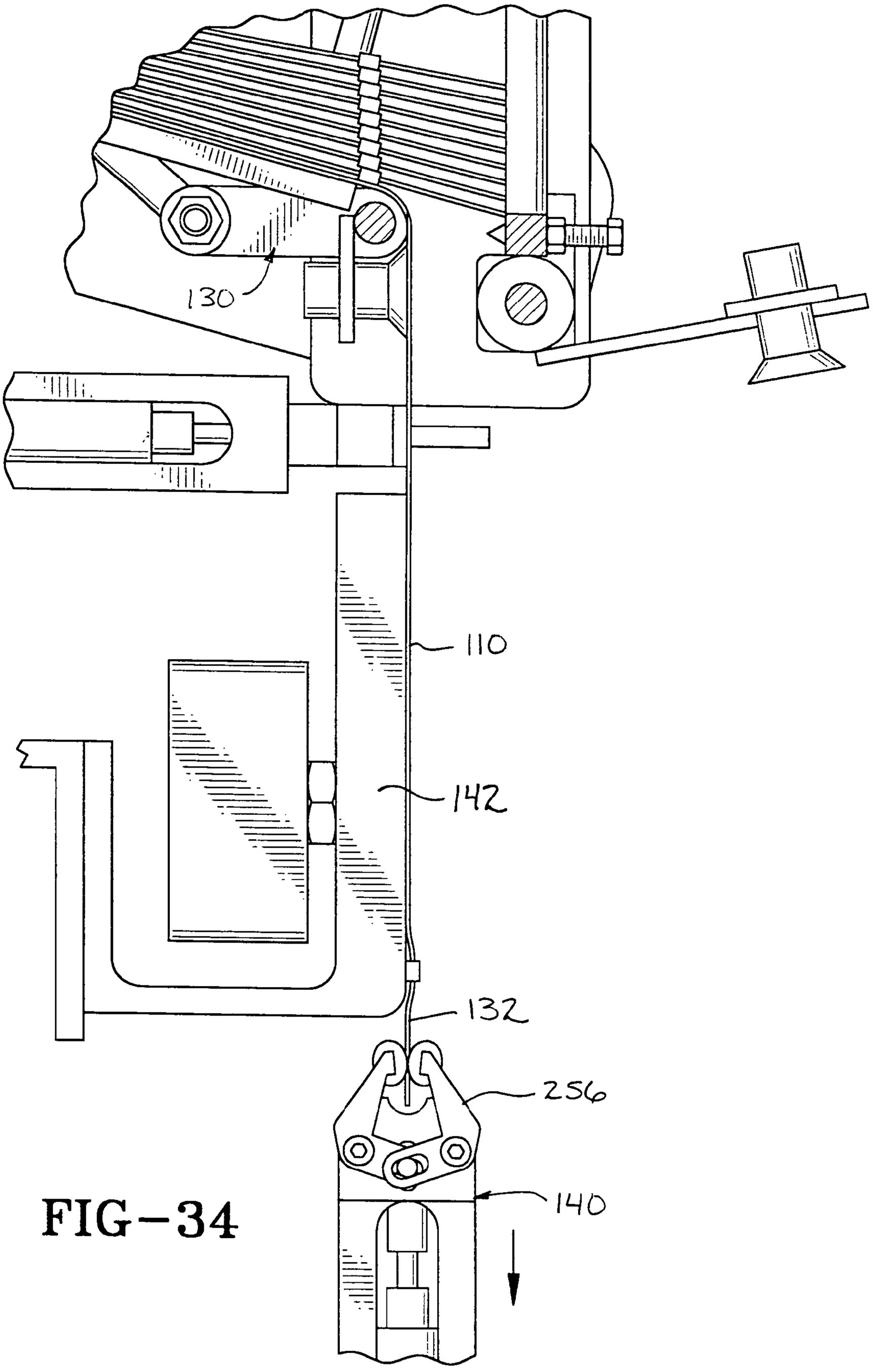

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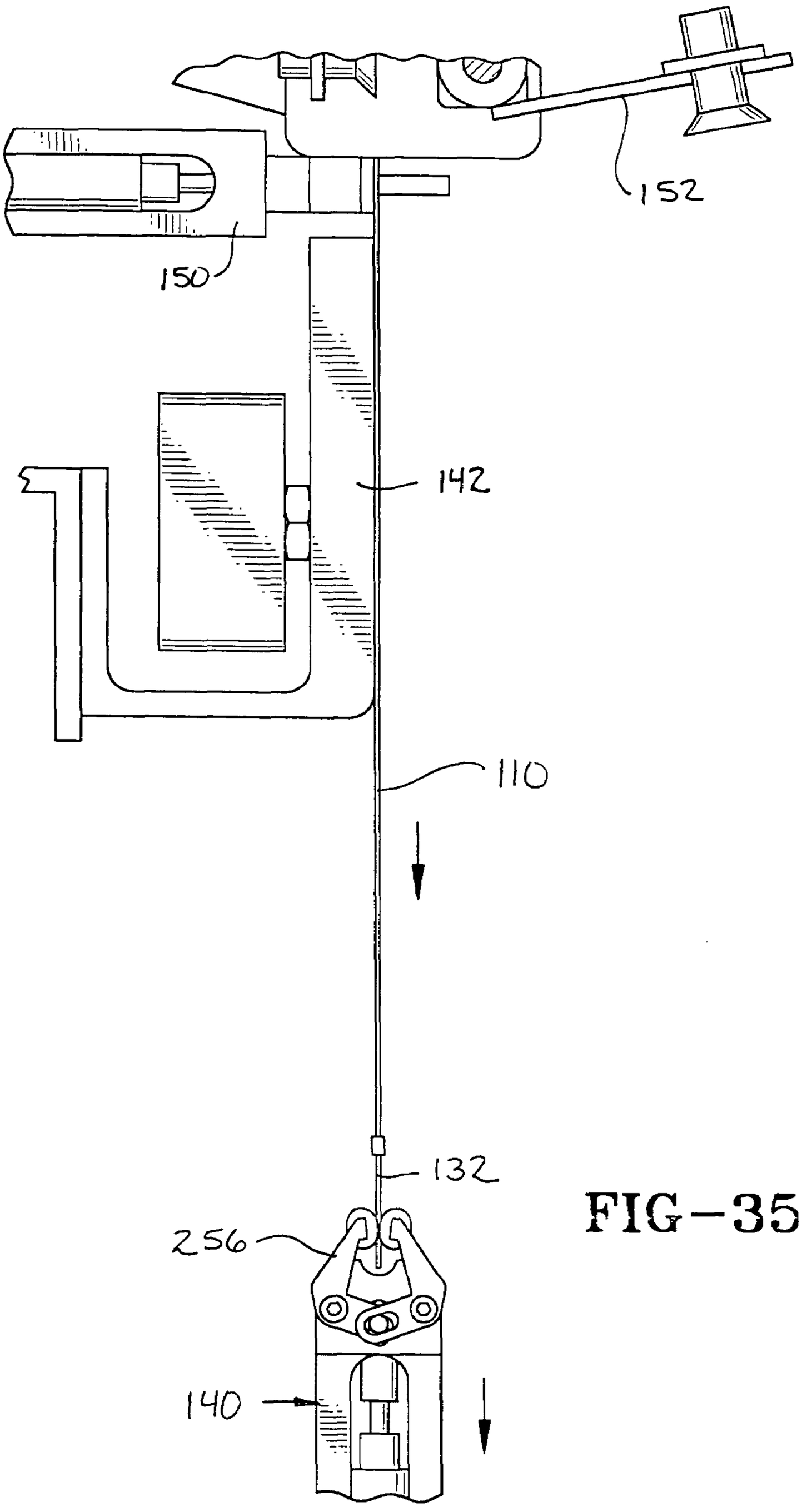

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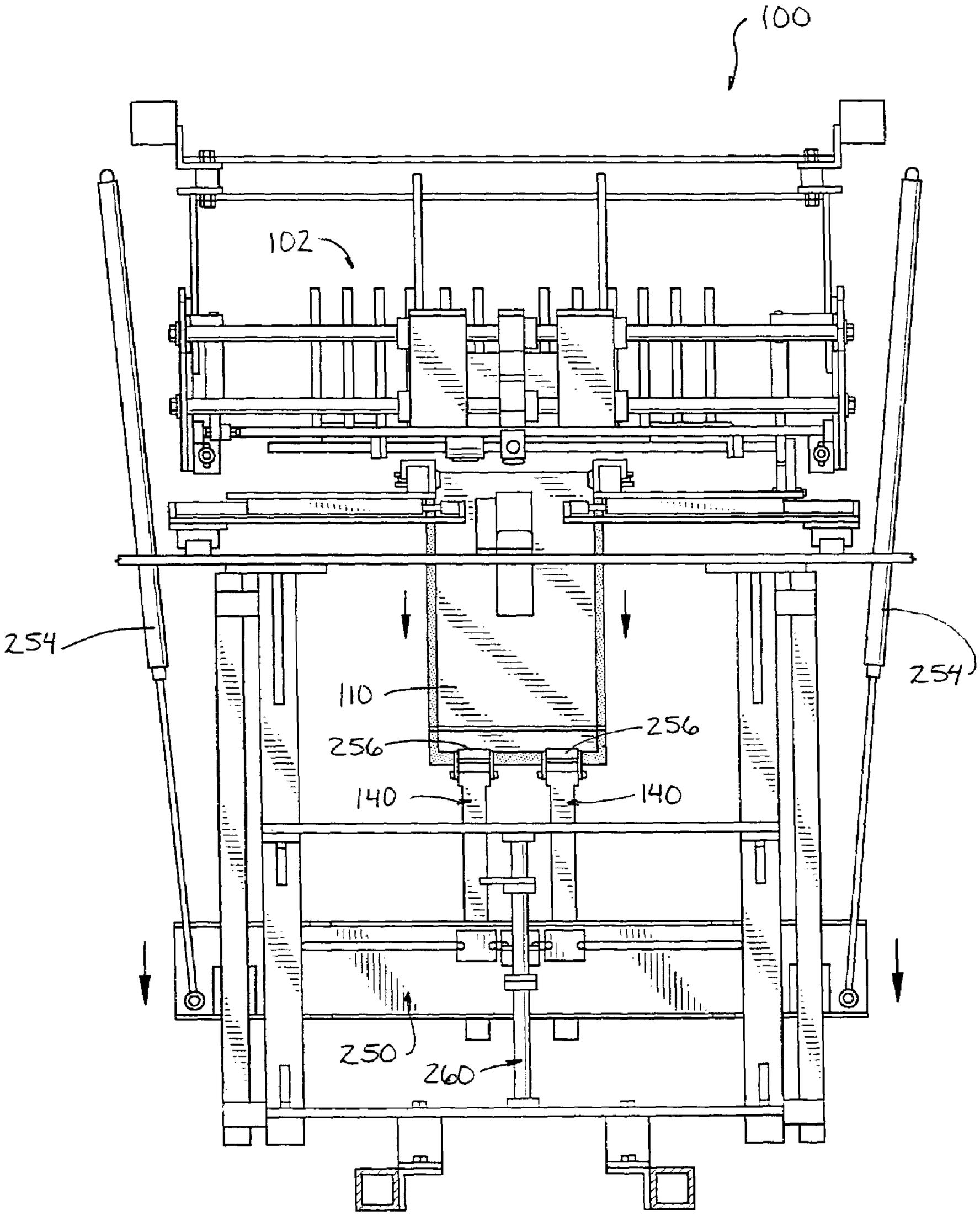

FIG-36

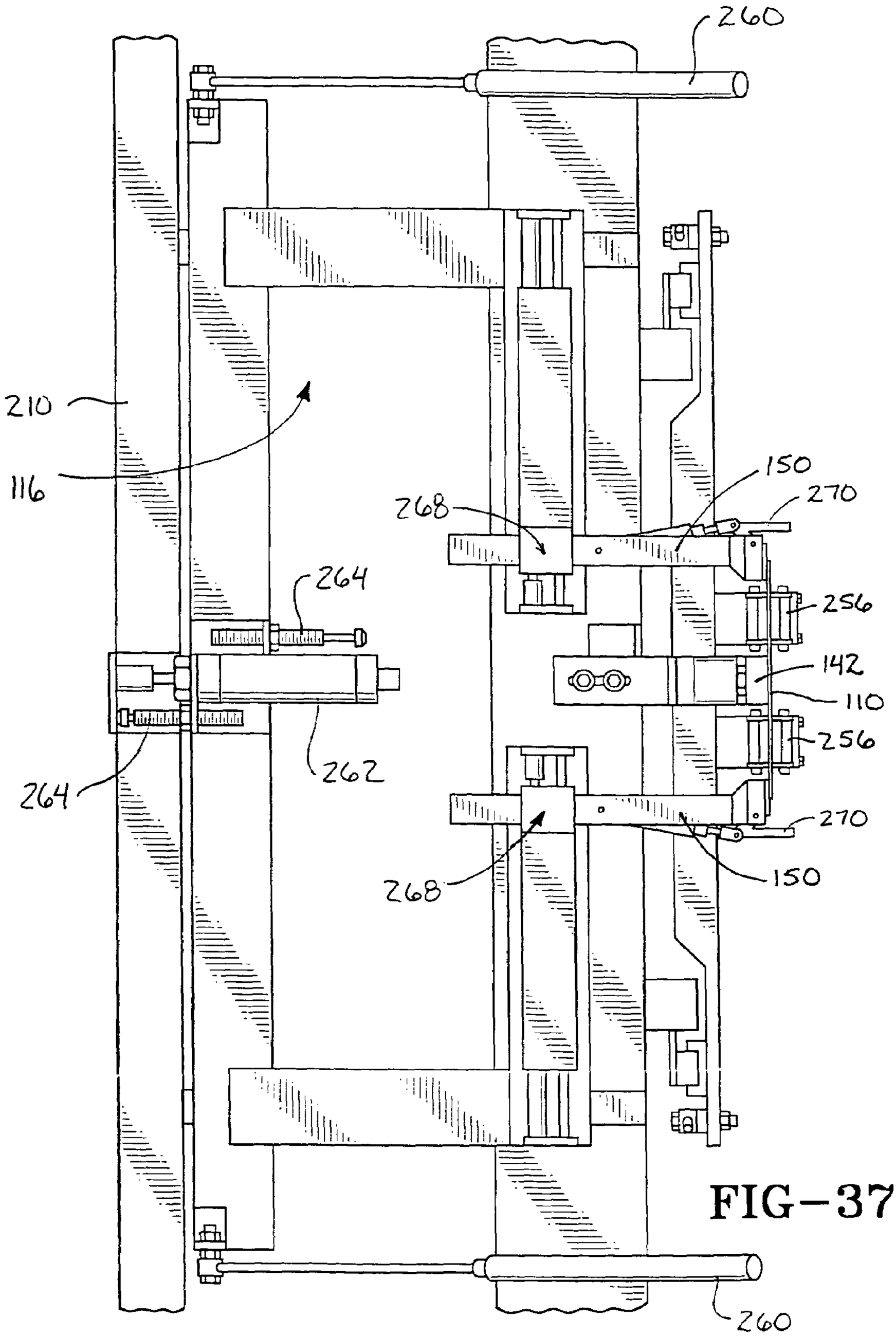
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FIG-37

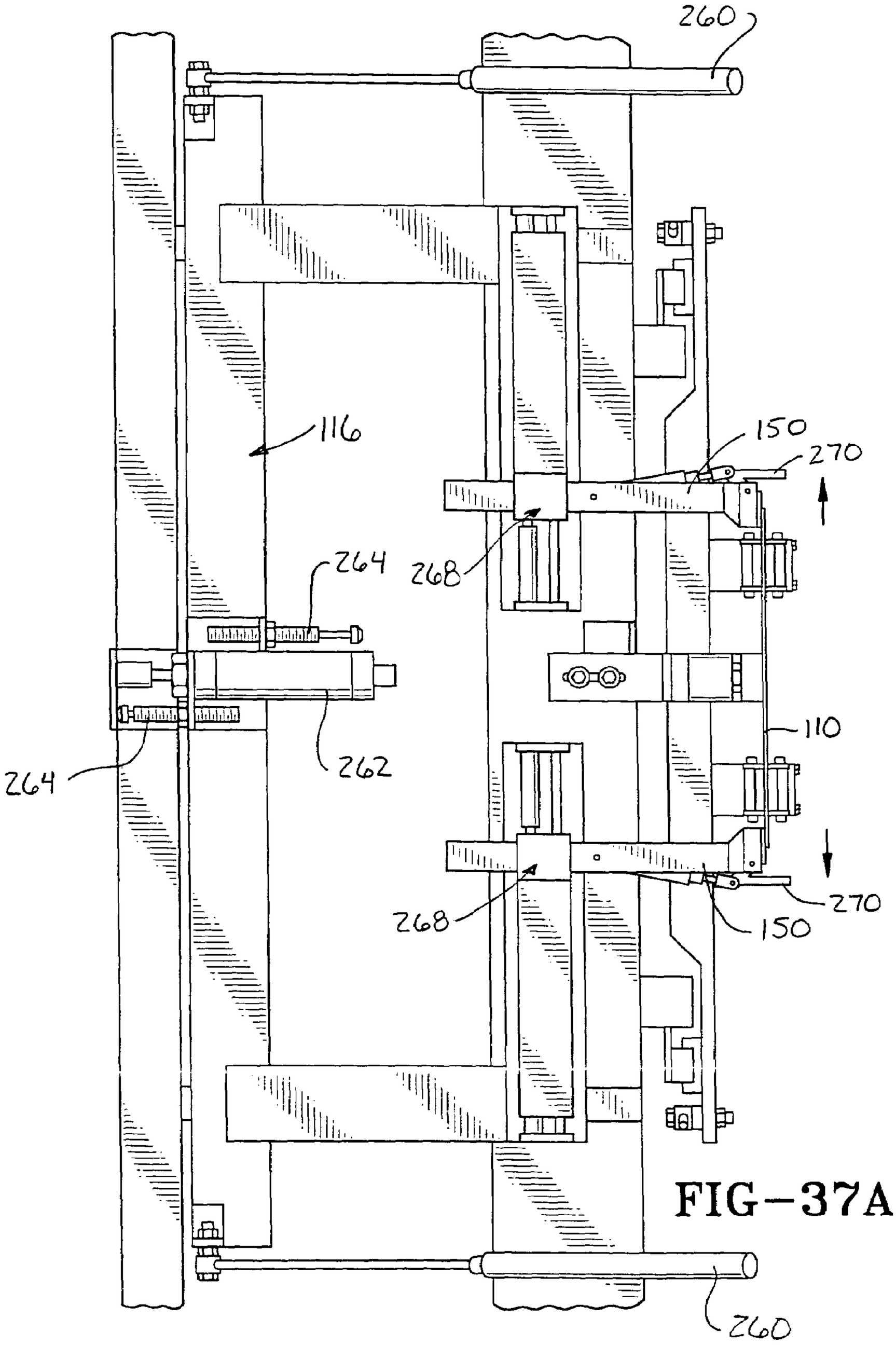

FIG-37A

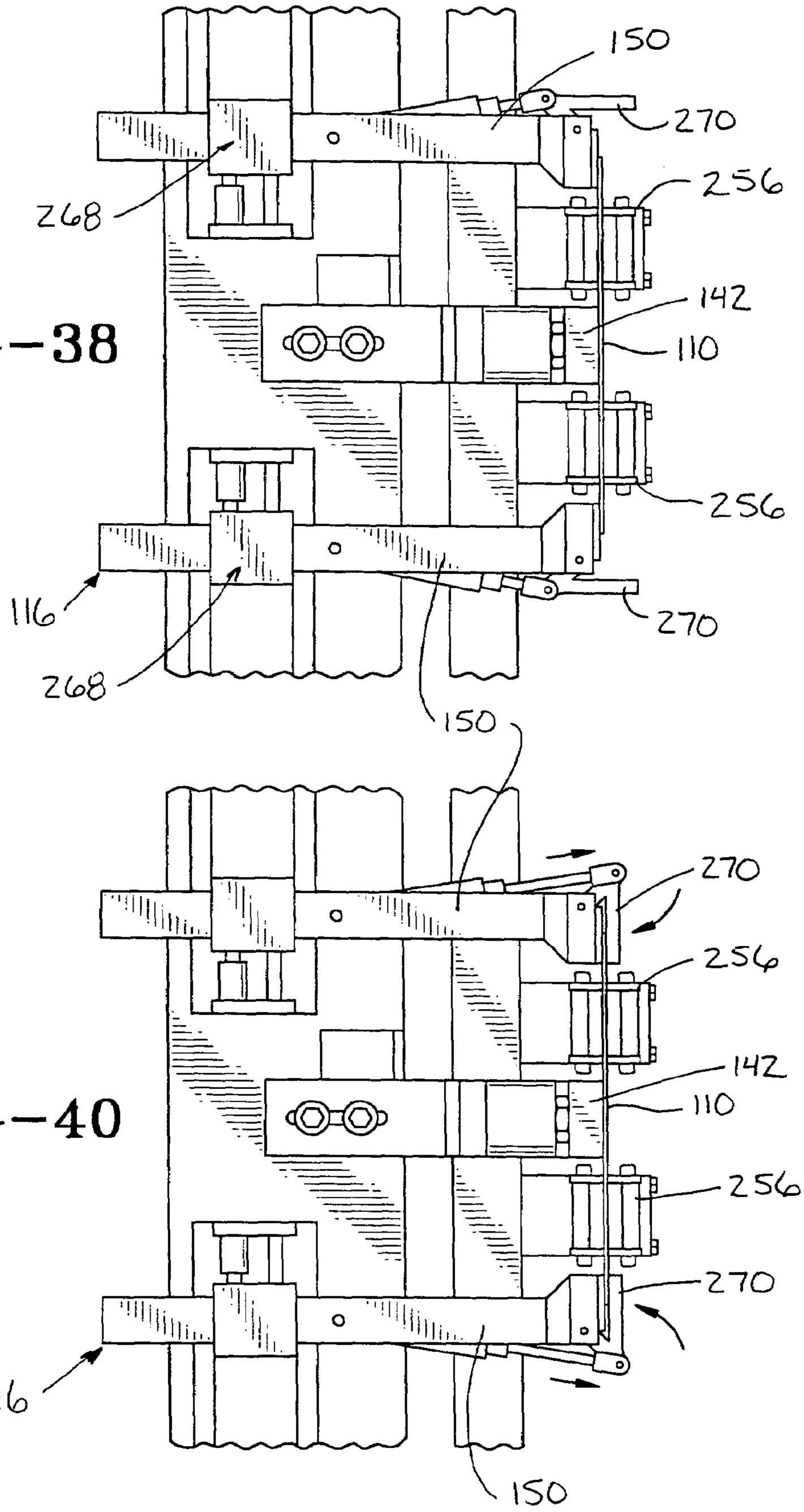
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FIG-38

FIG-40

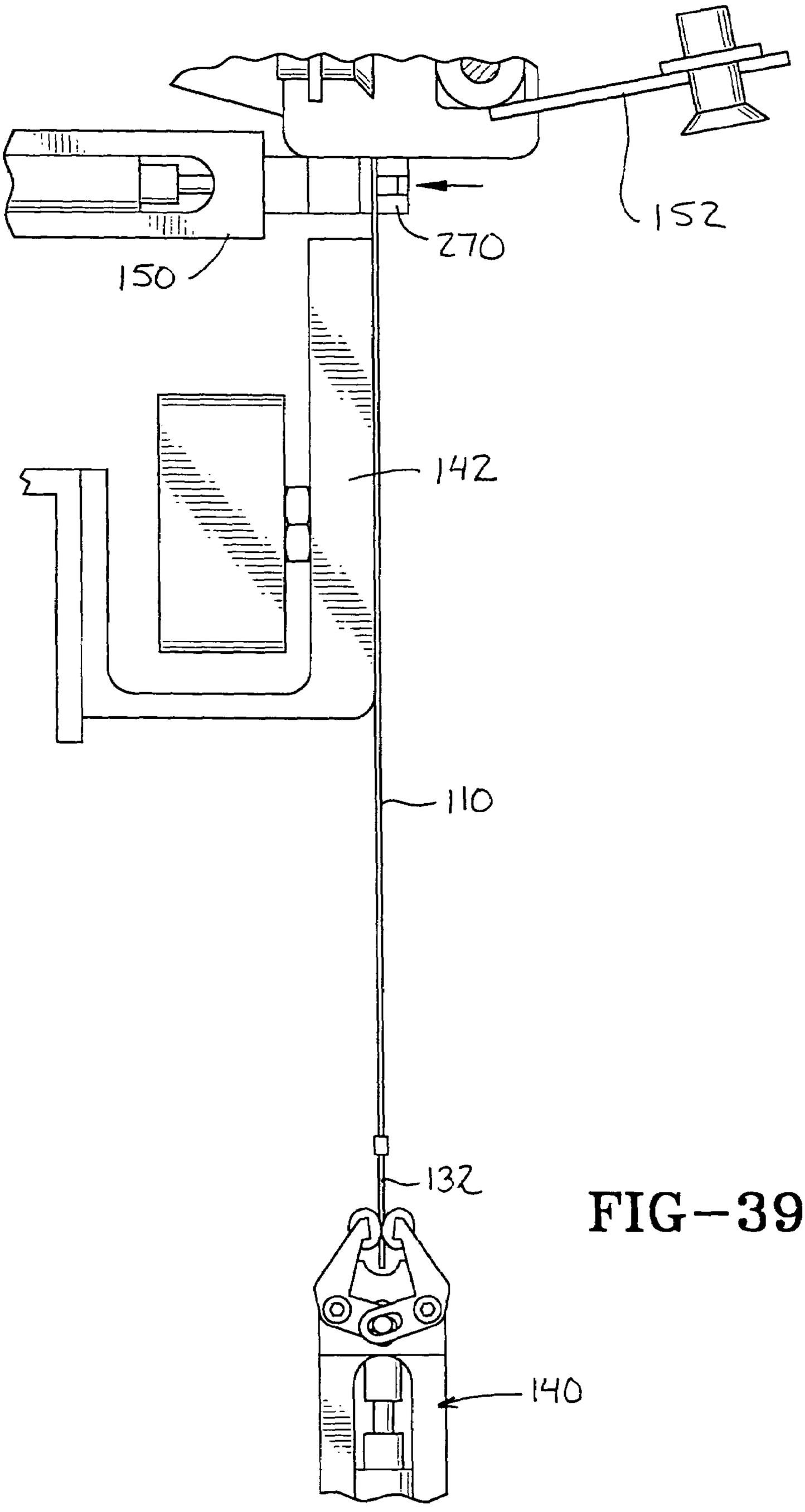


FIG-39

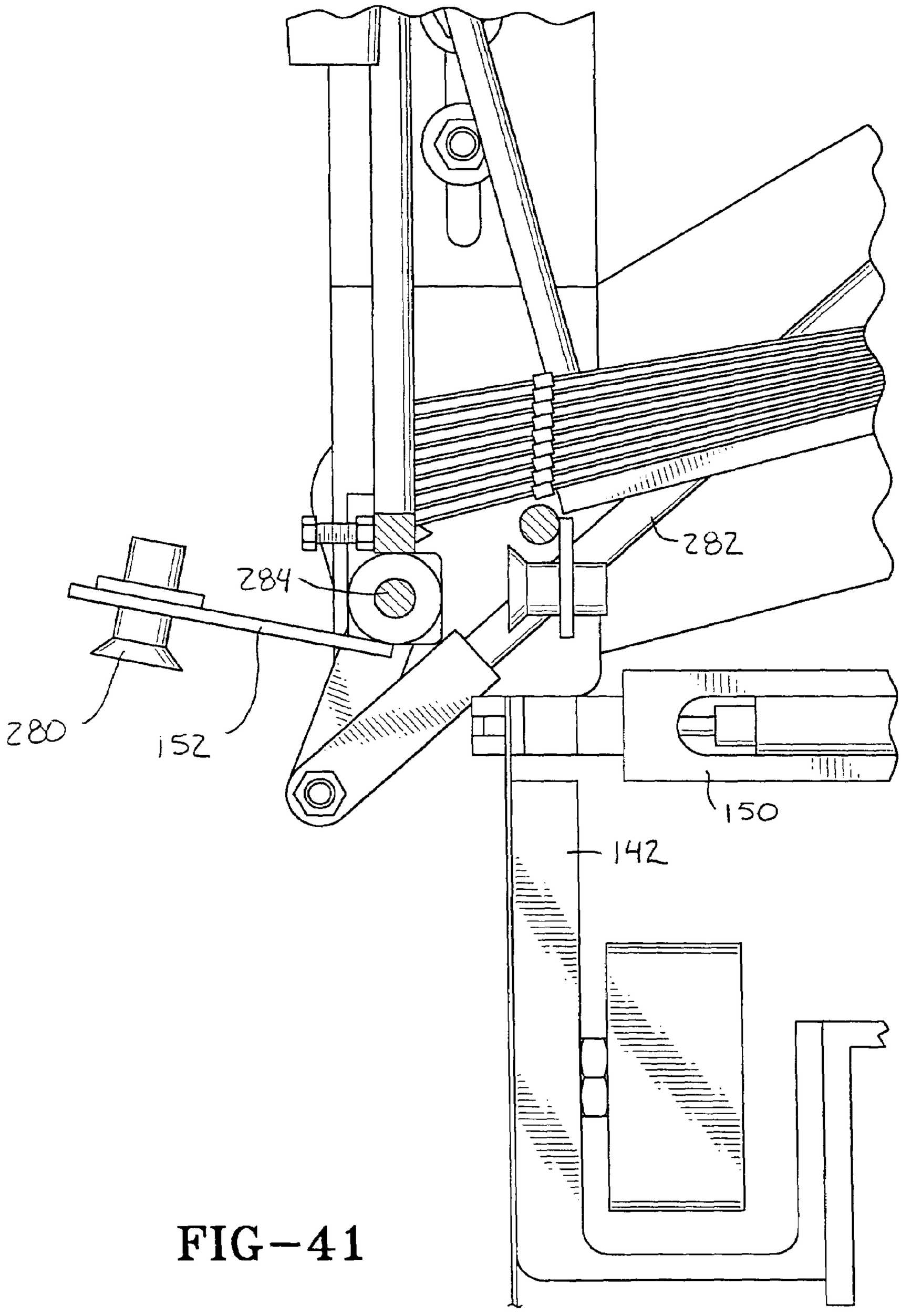


FIG-41

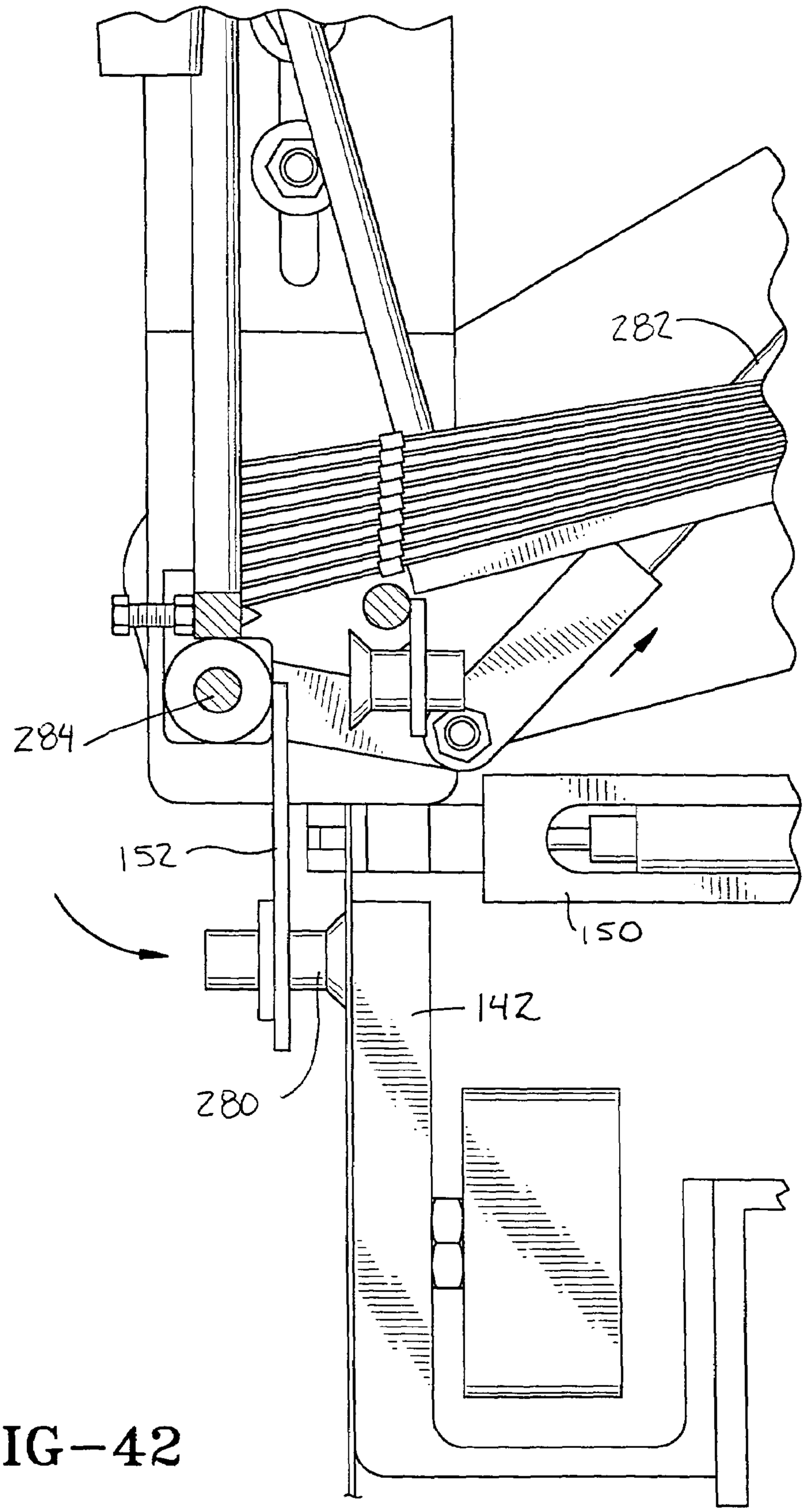


FIG-42

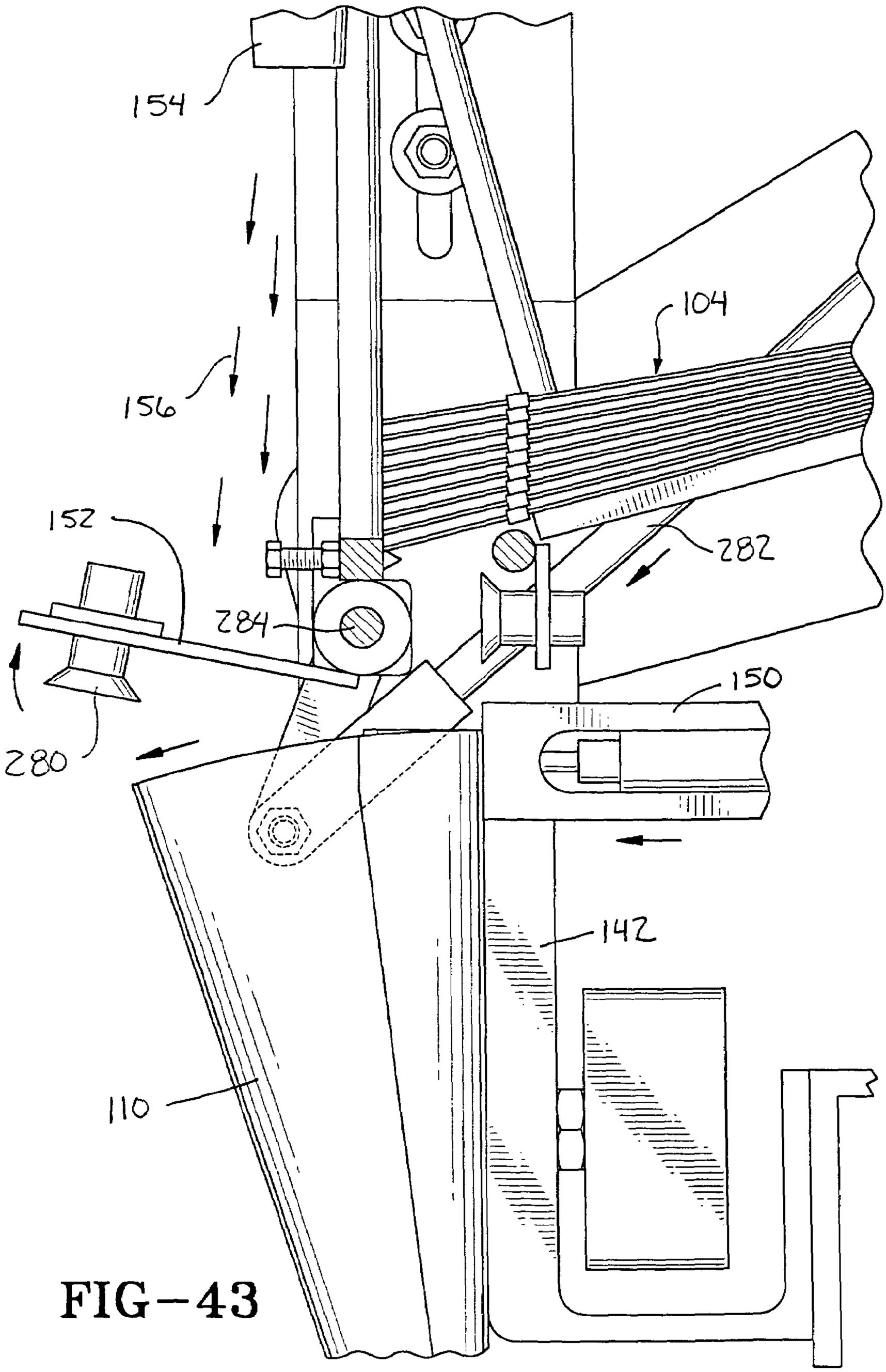


FIG-43

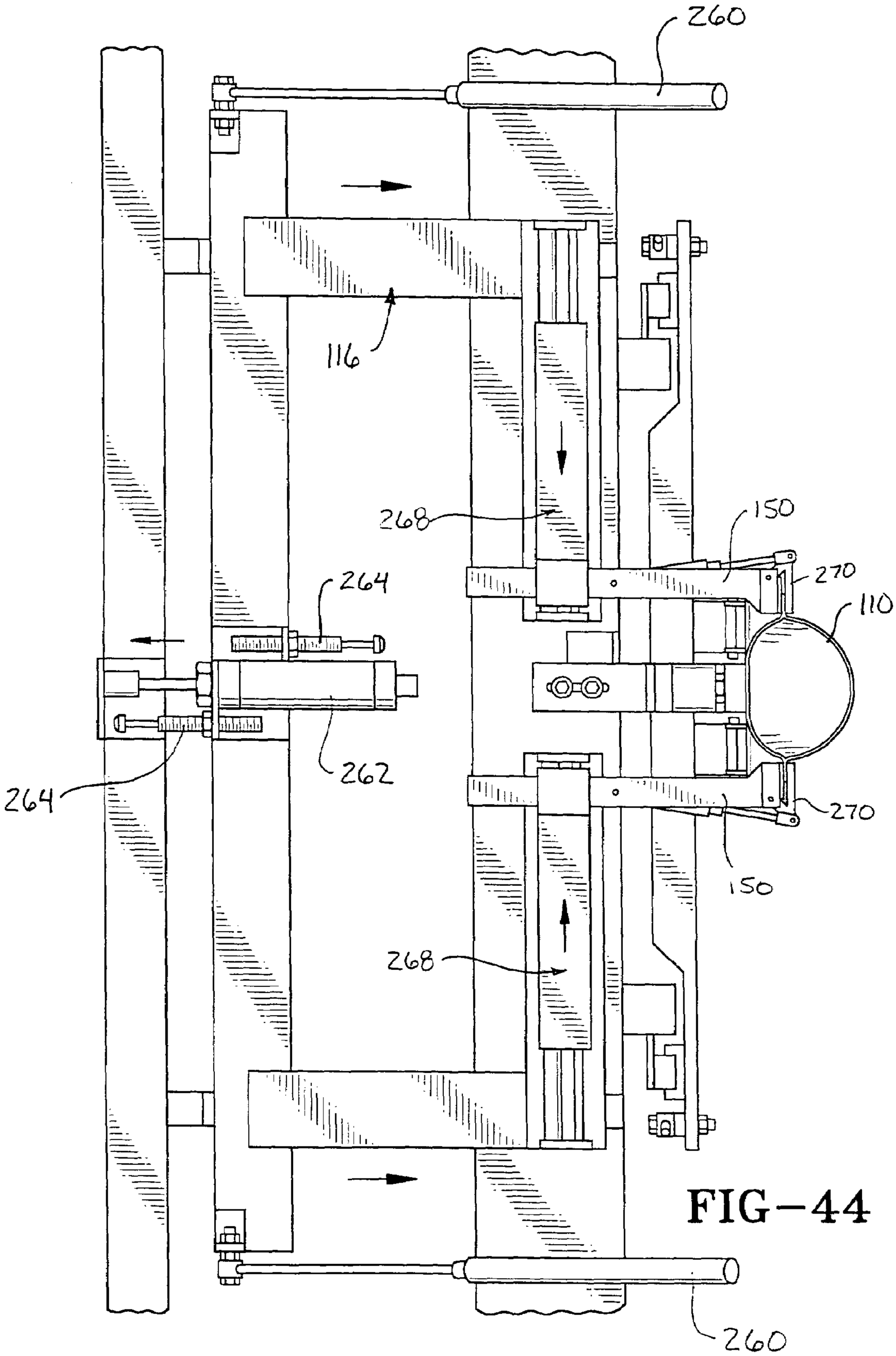


FIG-44

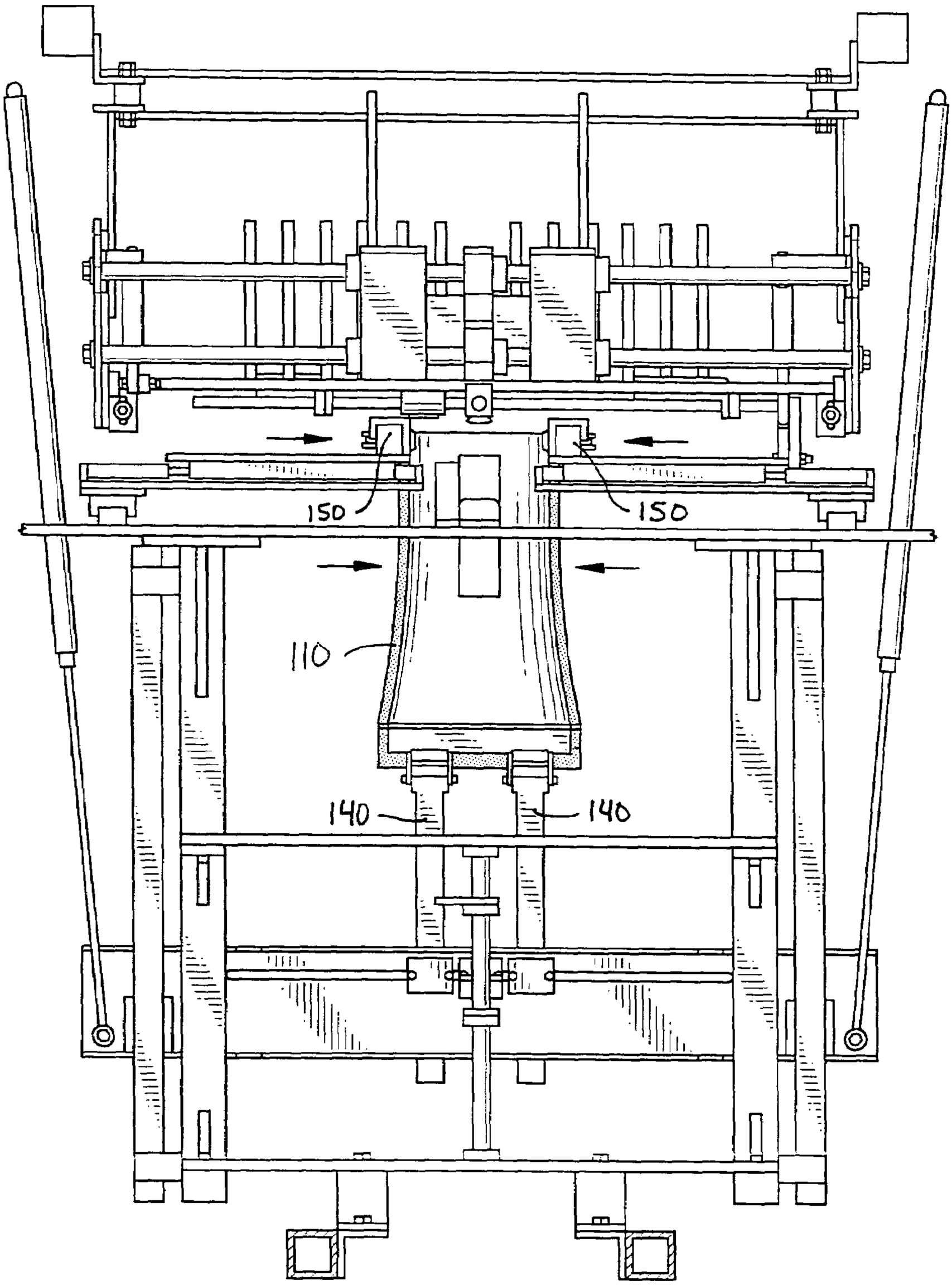


FIG-45

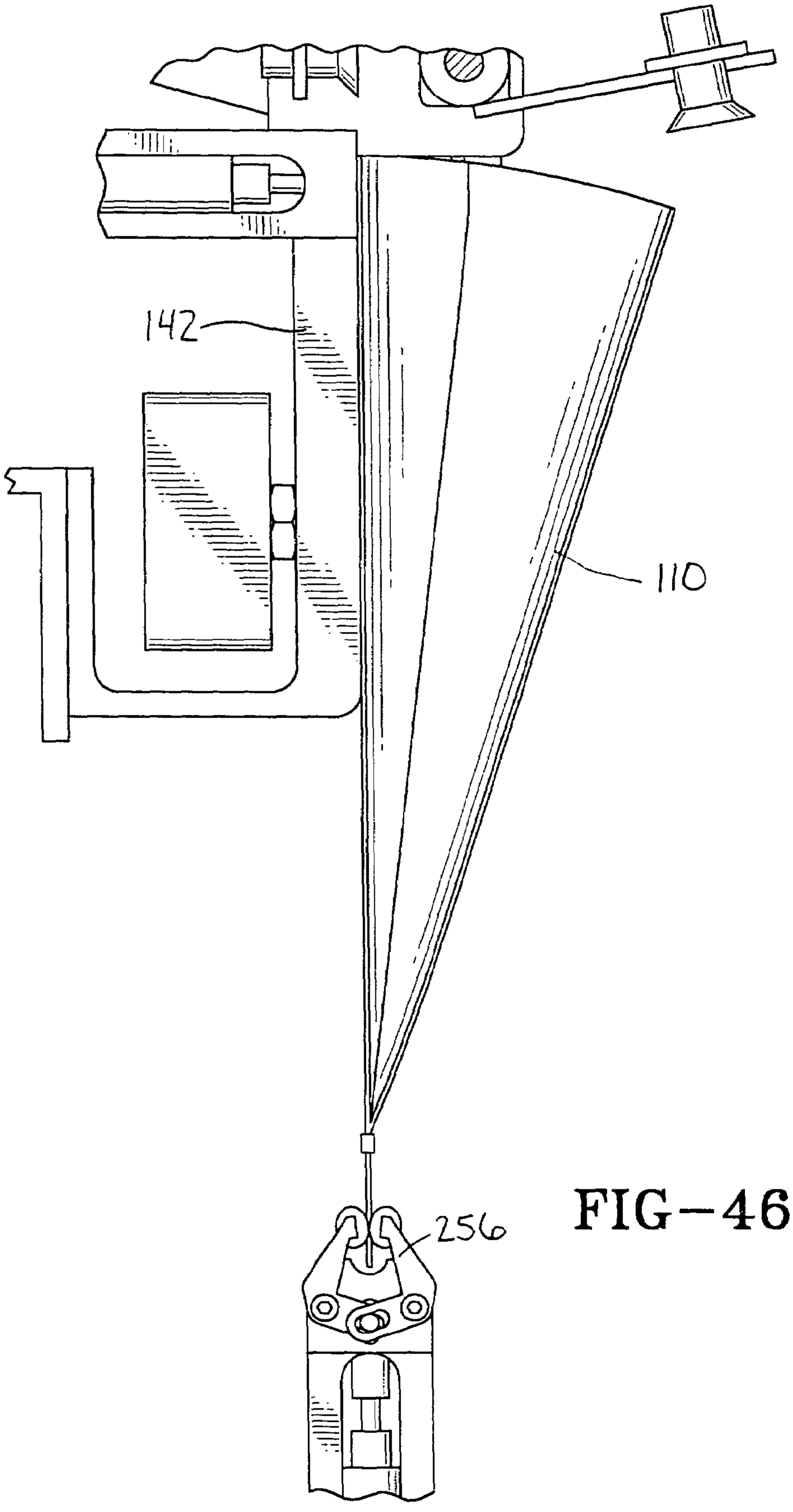


FIG-46

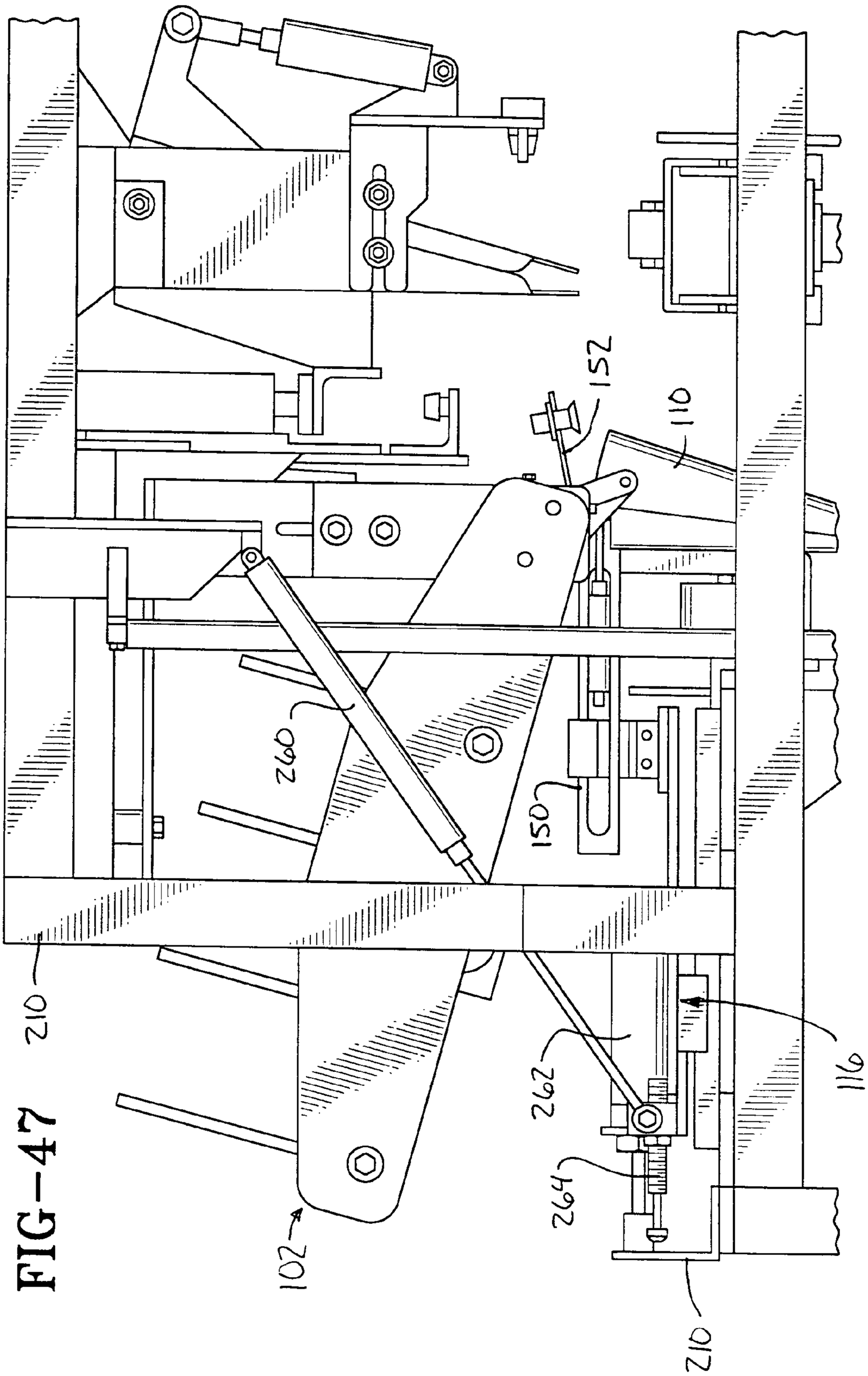


FIG-47

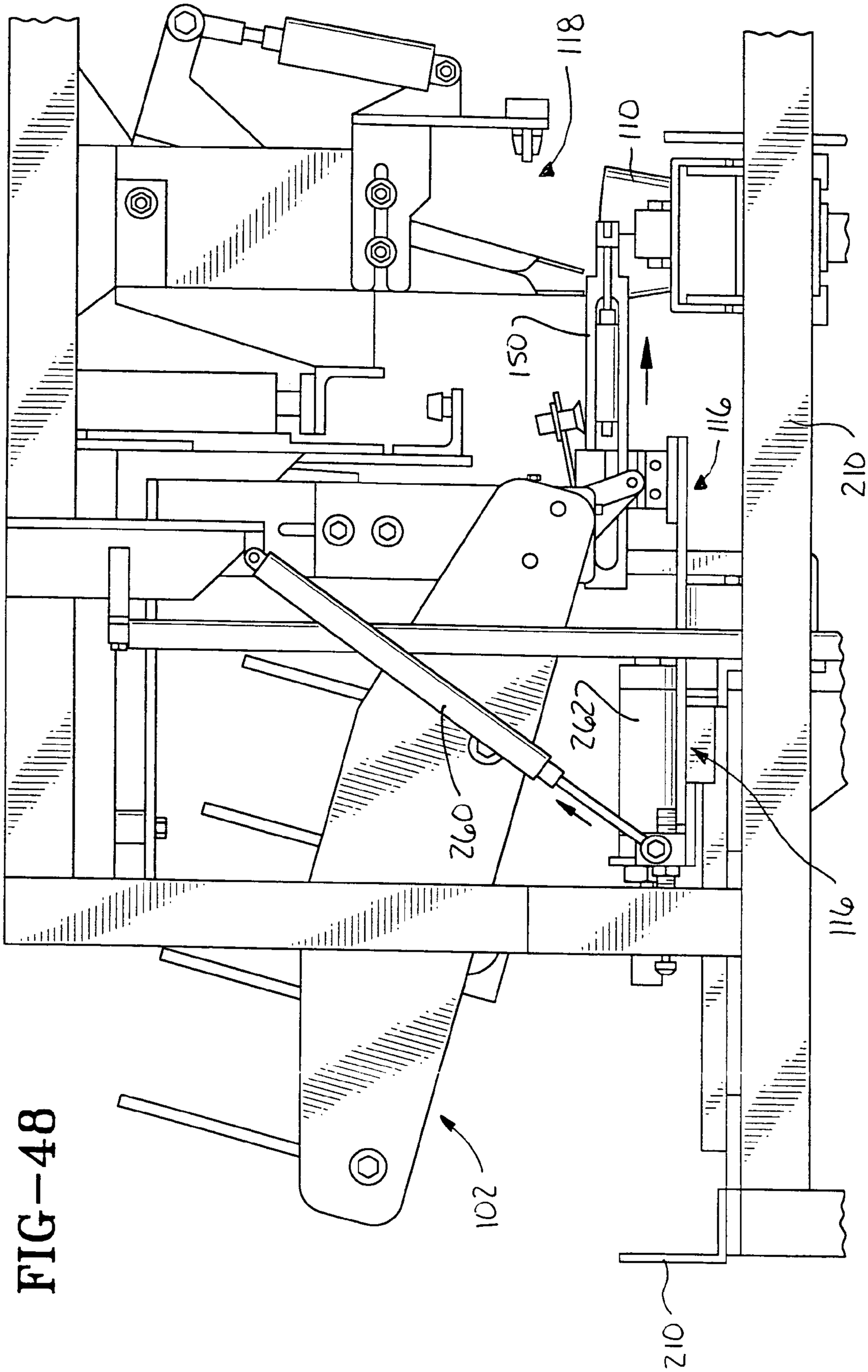
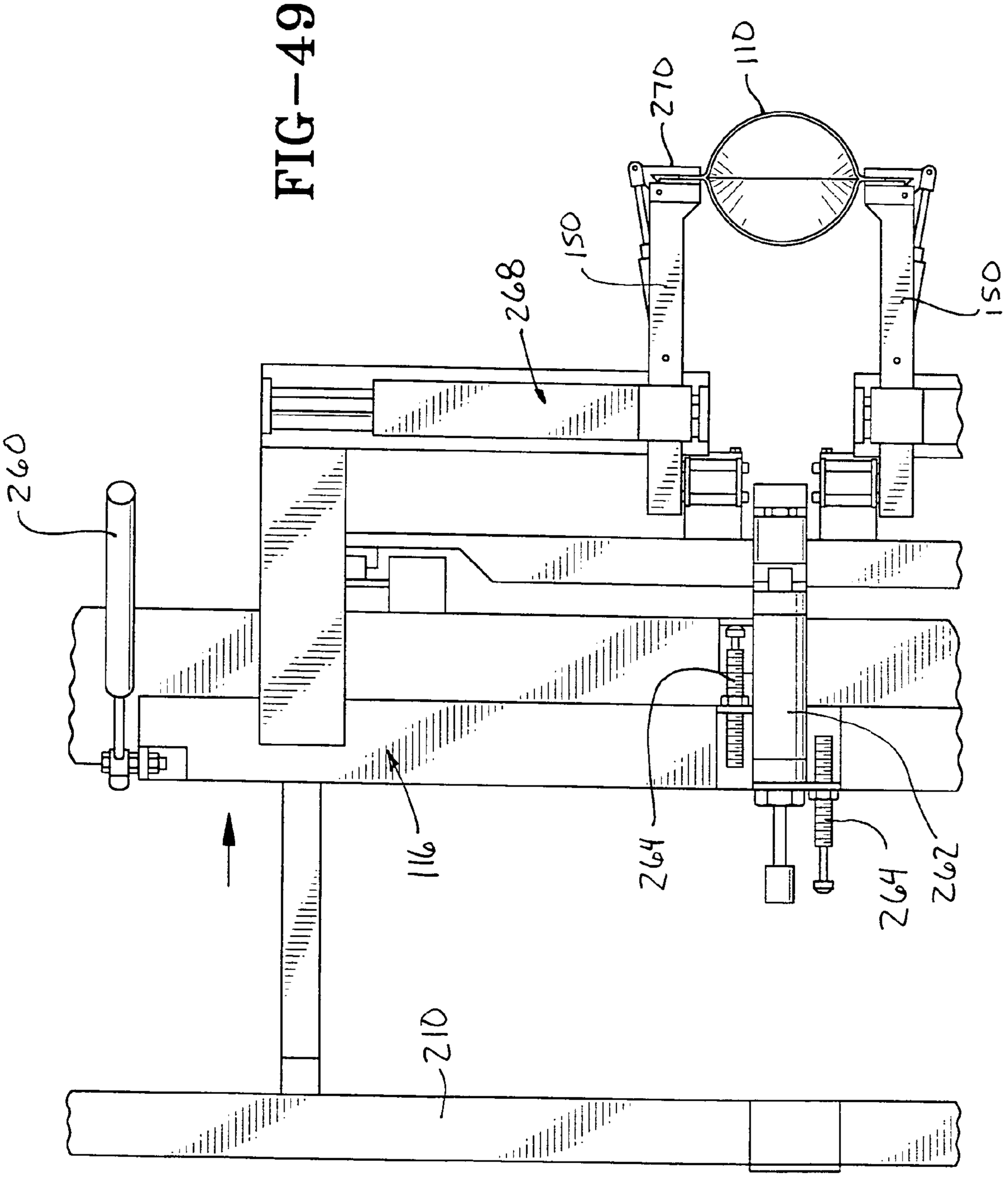


FIG-48

FIG-49



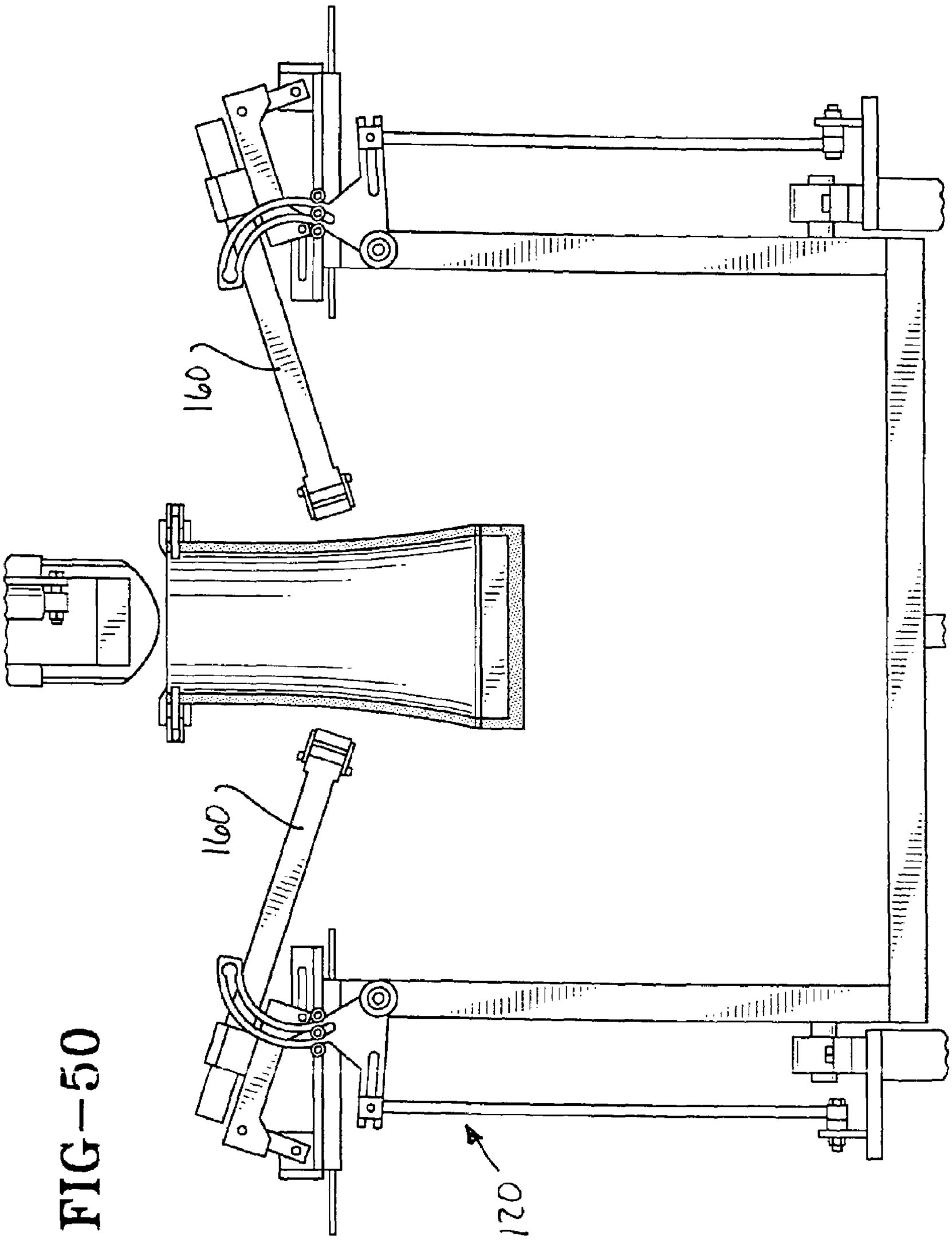


FIG-50

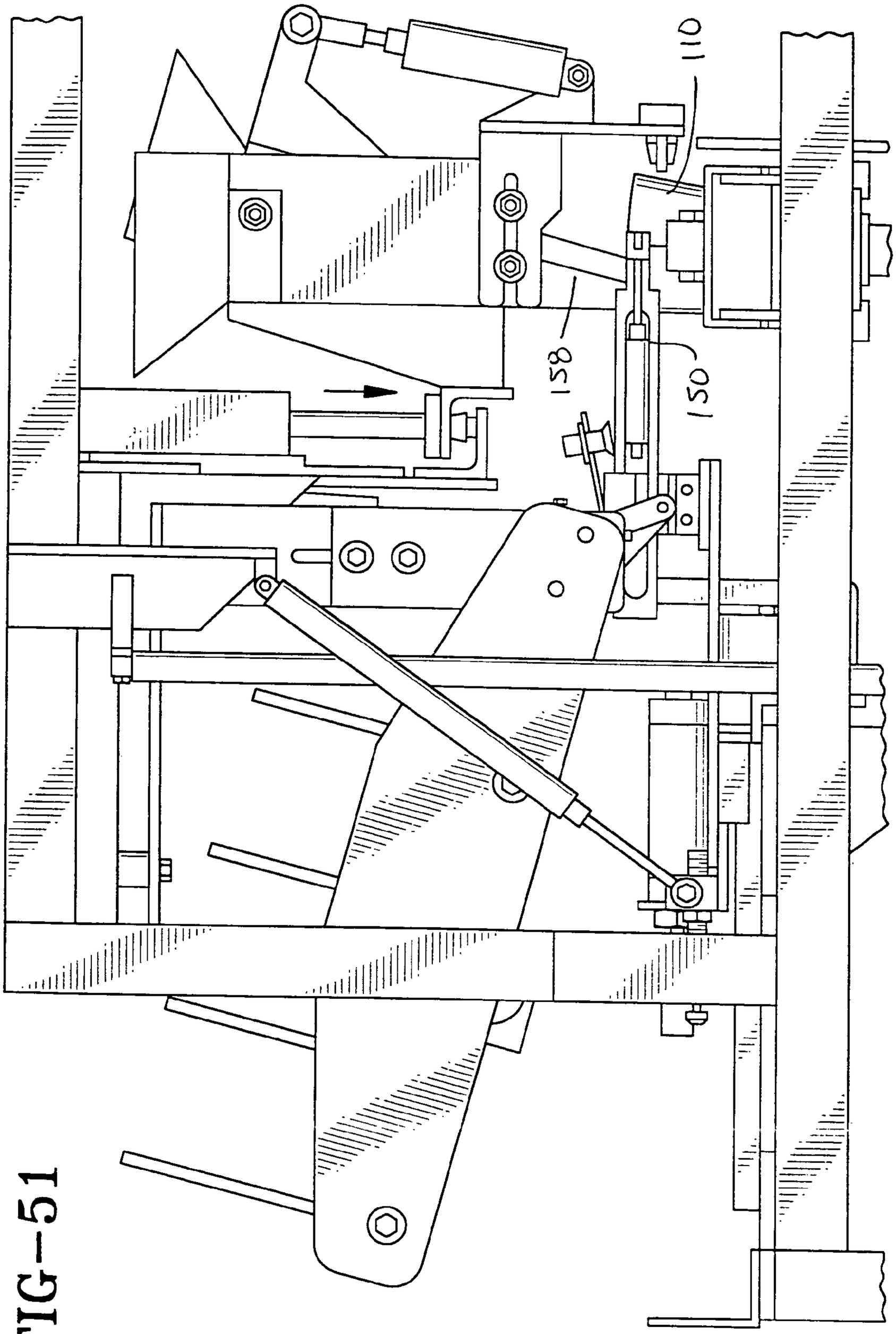


FIG-51

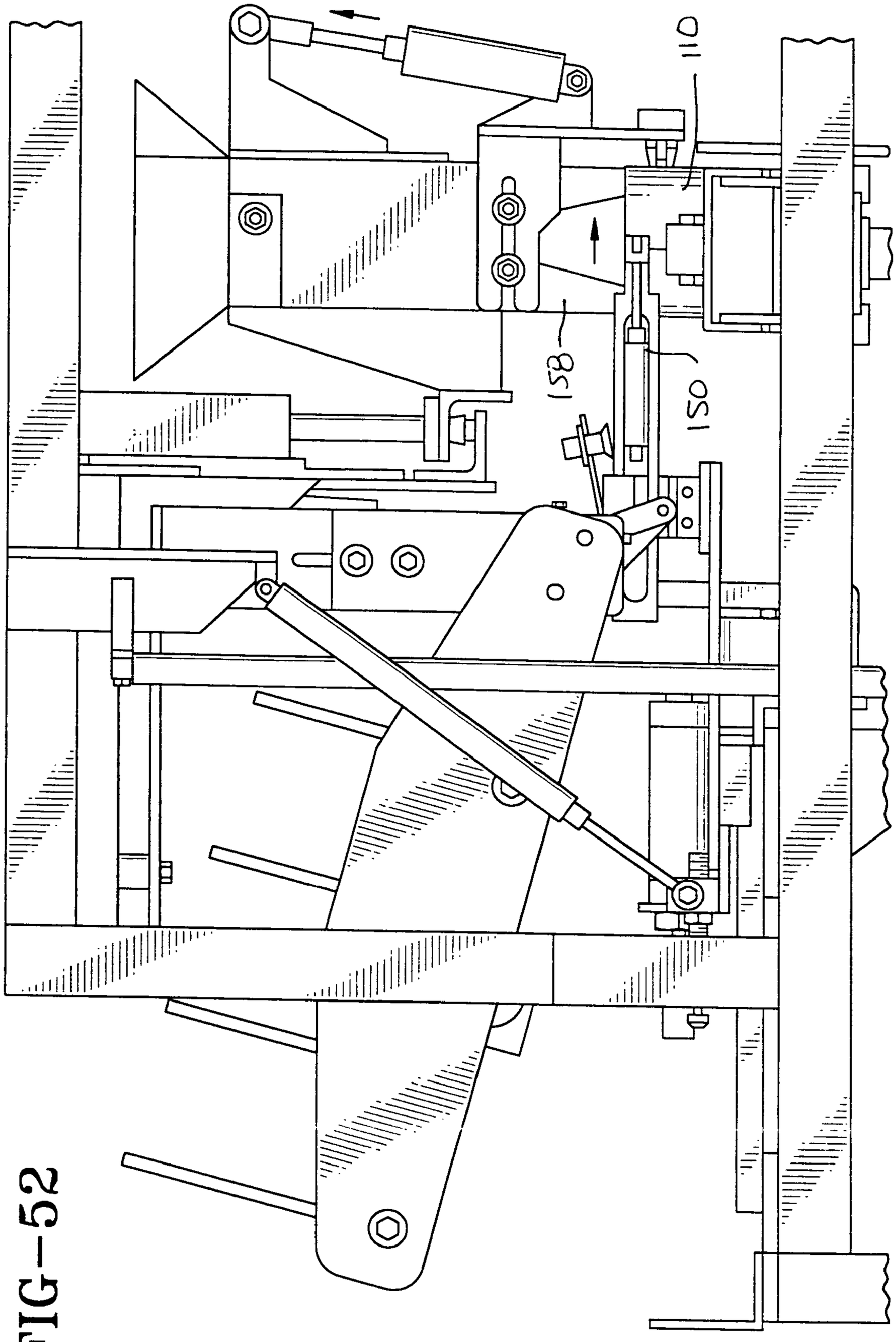


FIG-52

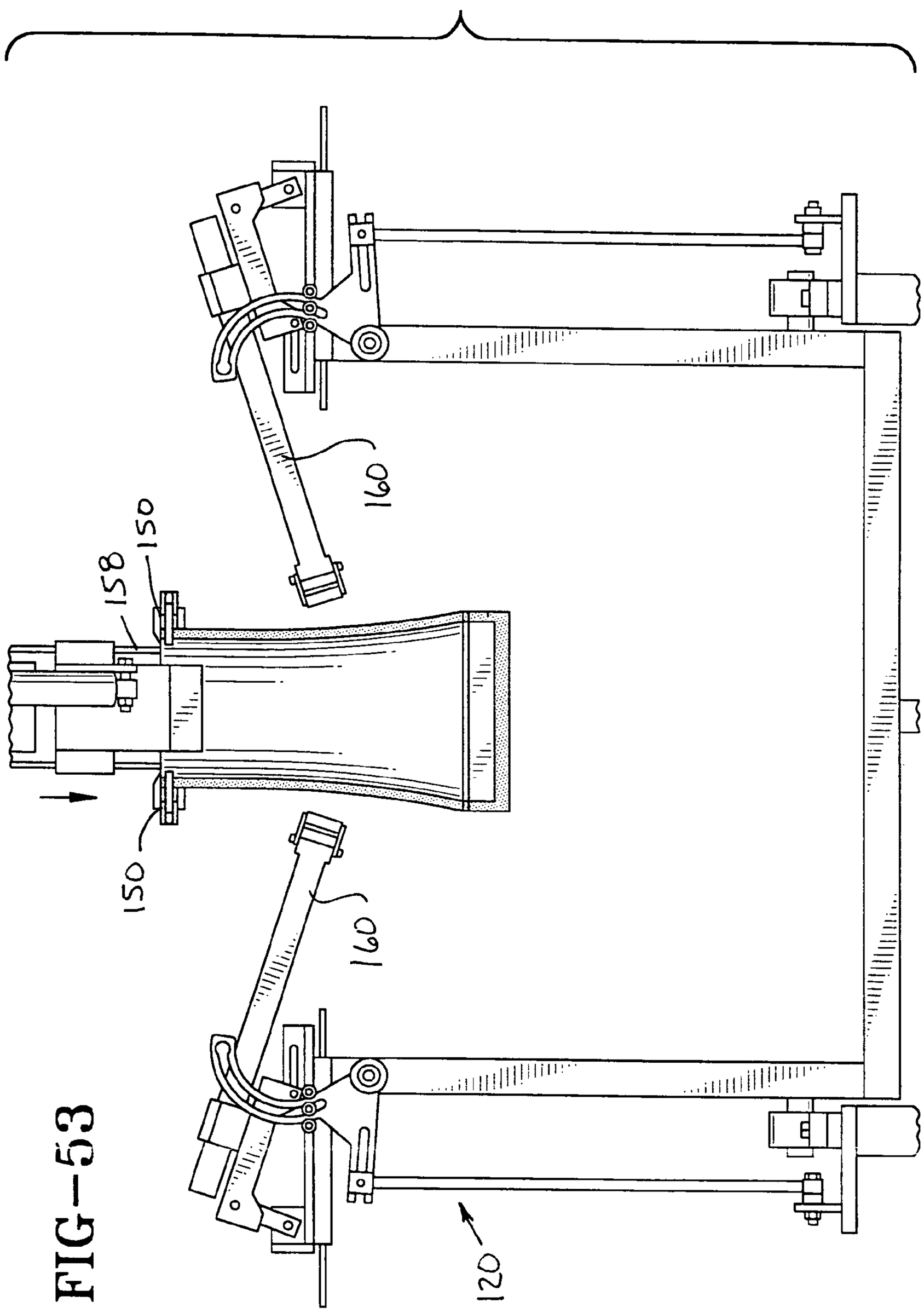


FIG-53

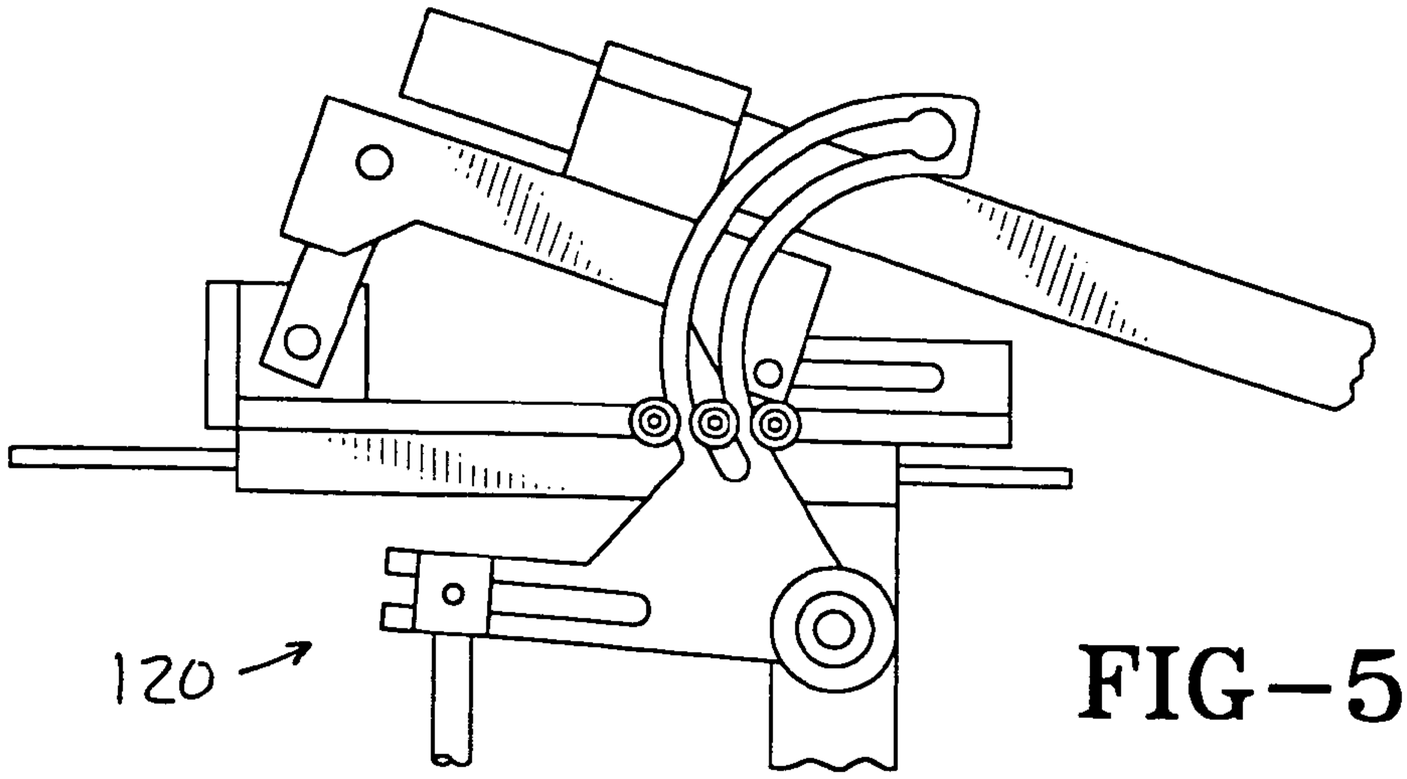


FIG-53A

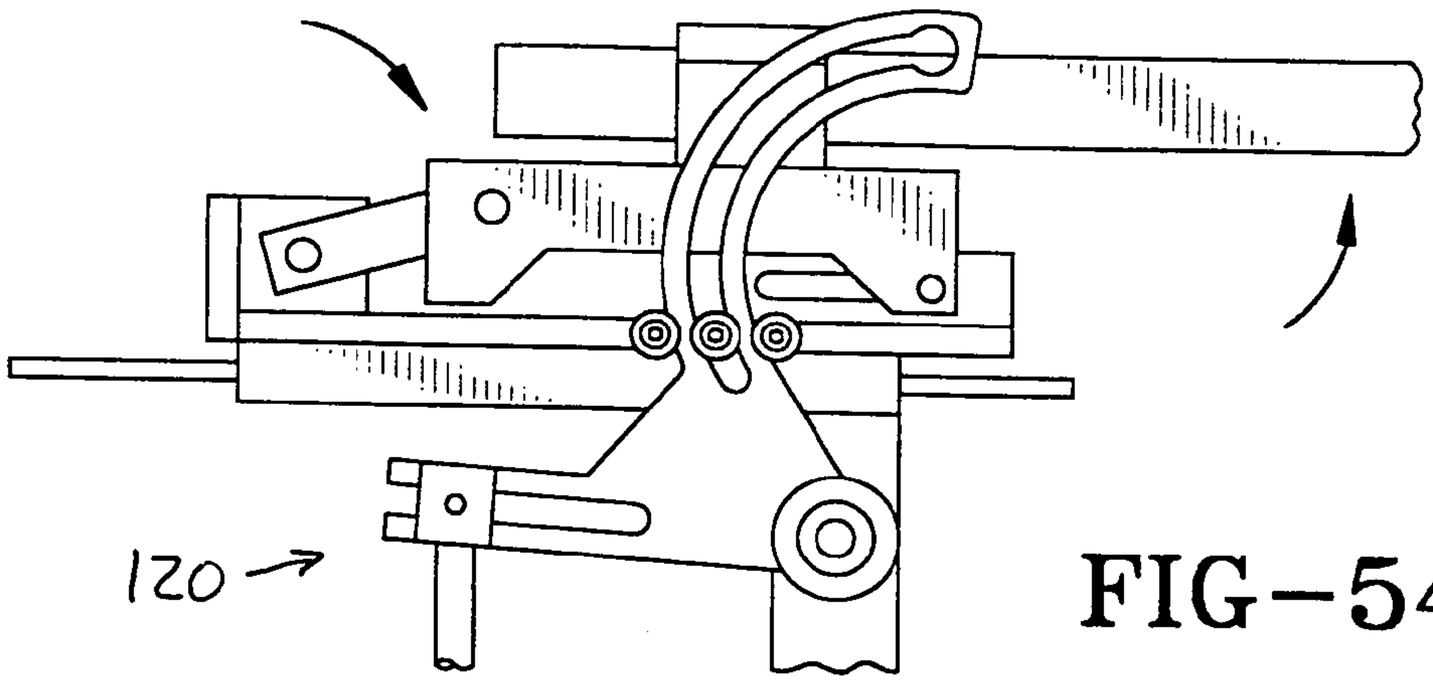


FIG-54A

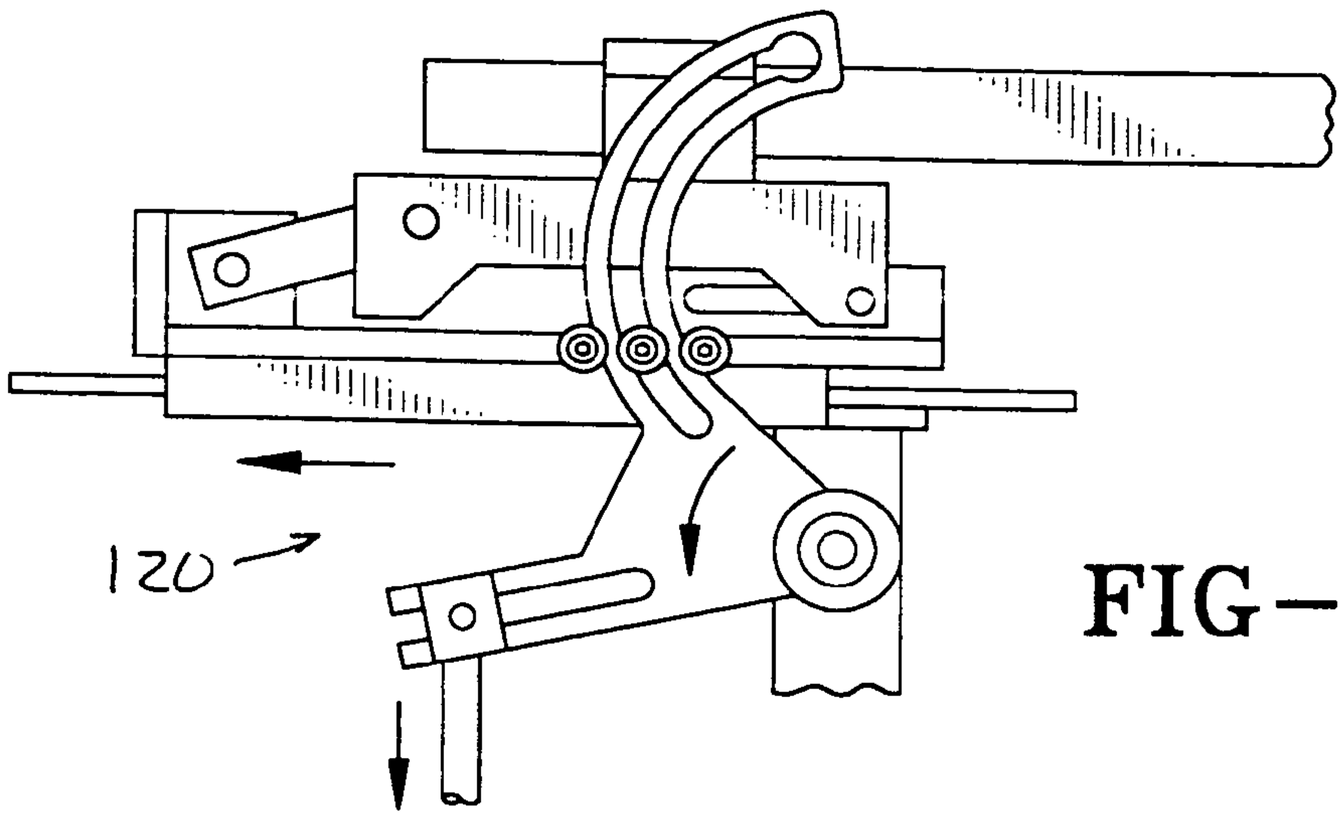


FIG-62A

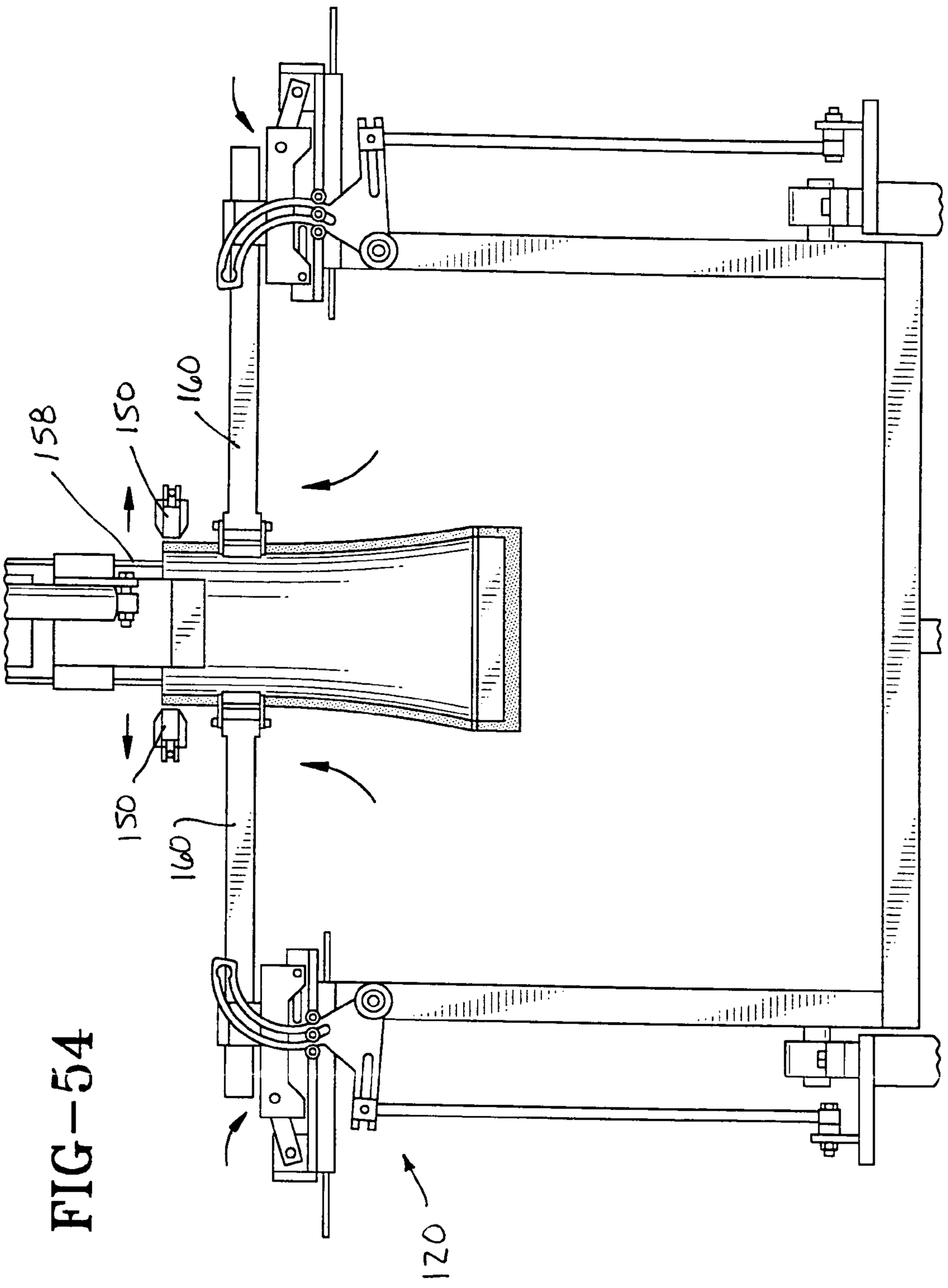


FIG-54

FIG-55

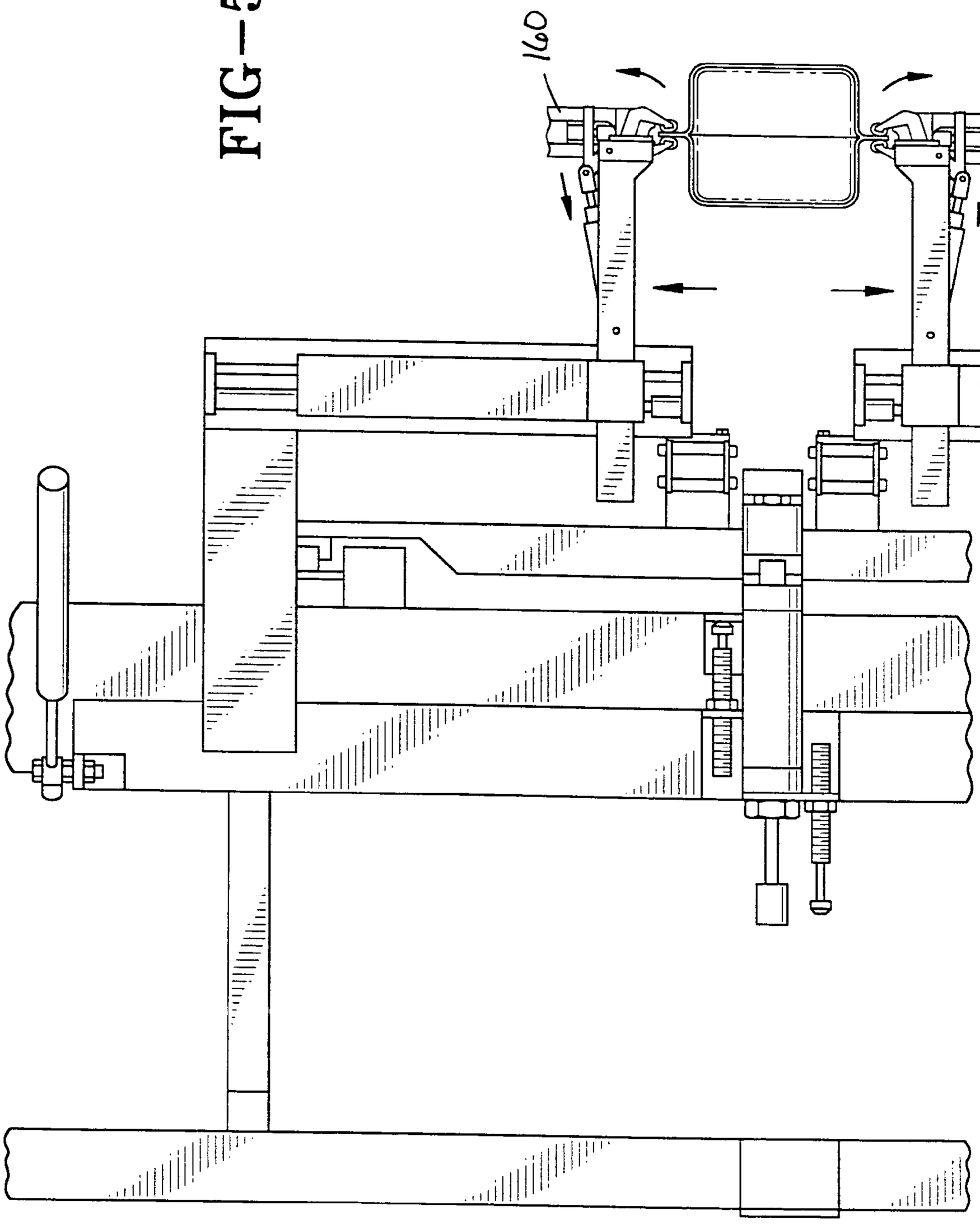
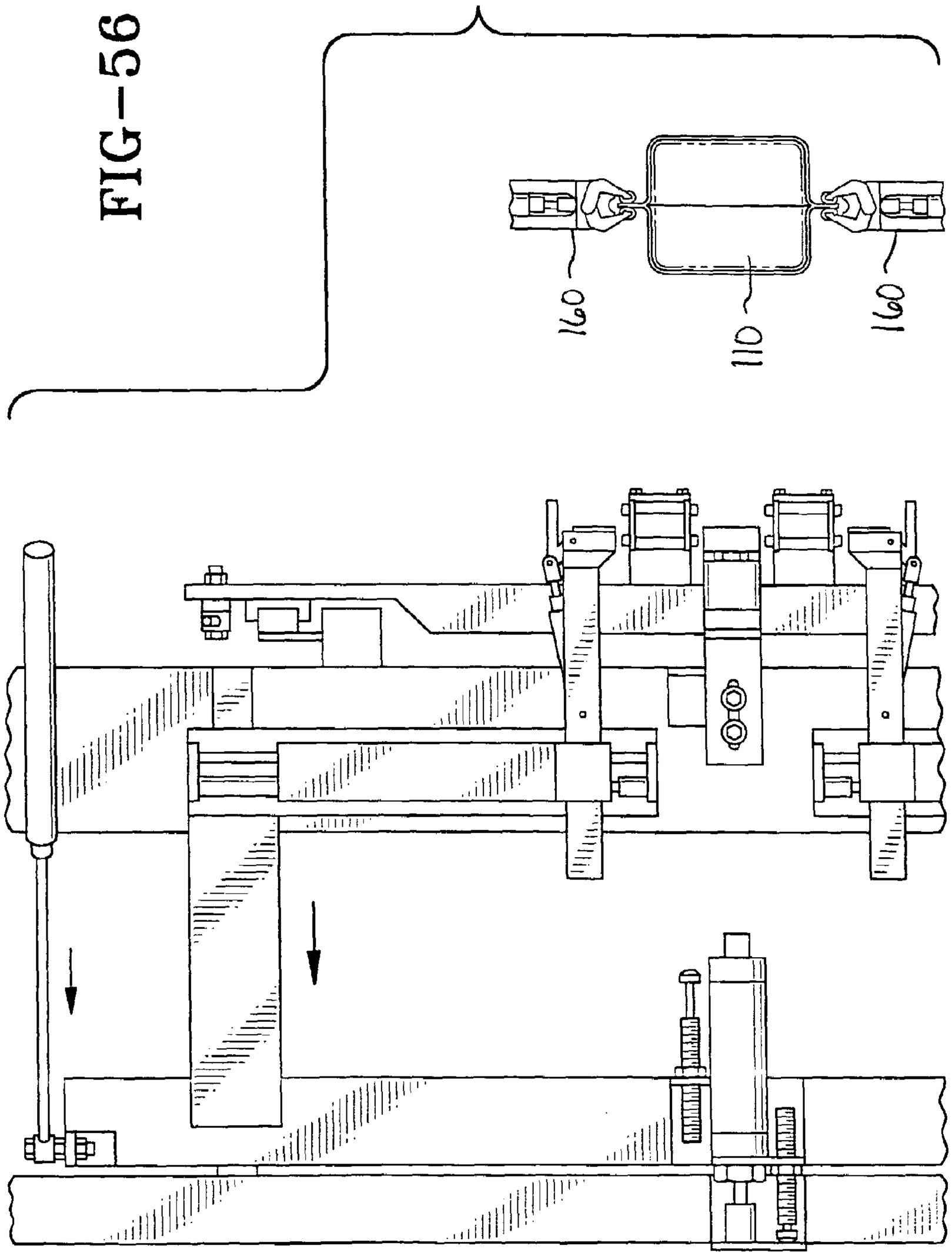


FIG-56



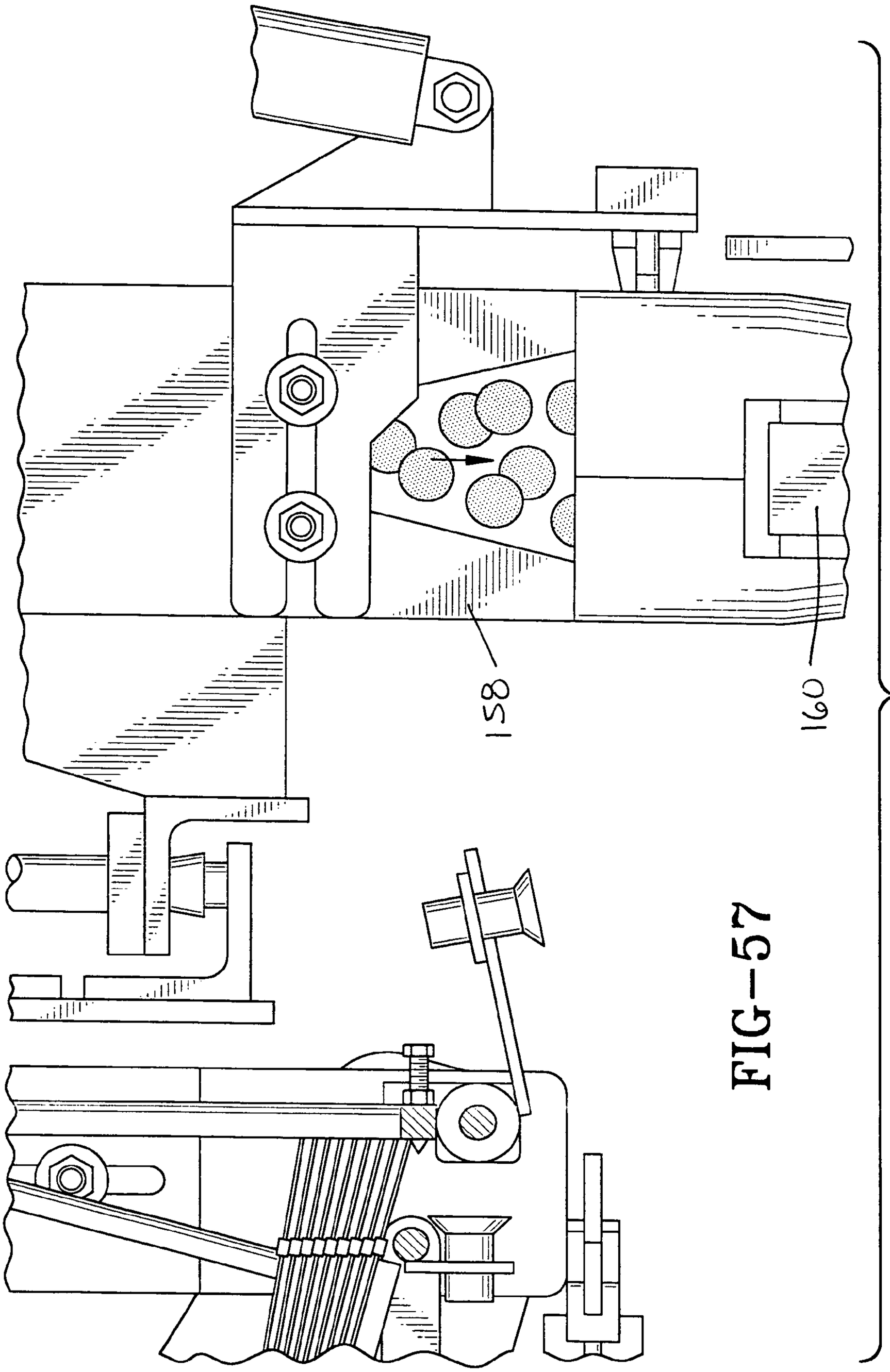
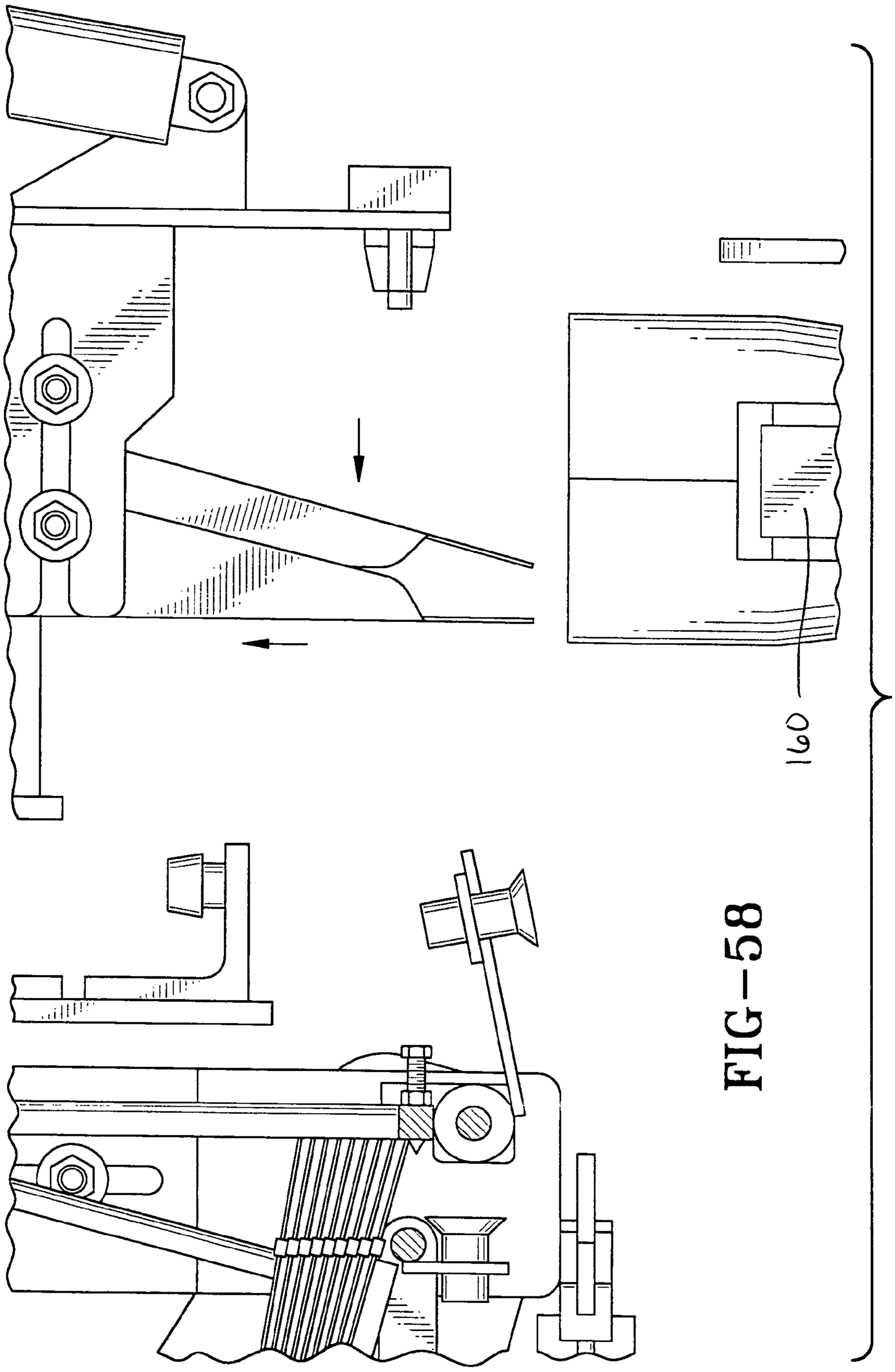


FIG-57



FIG—58

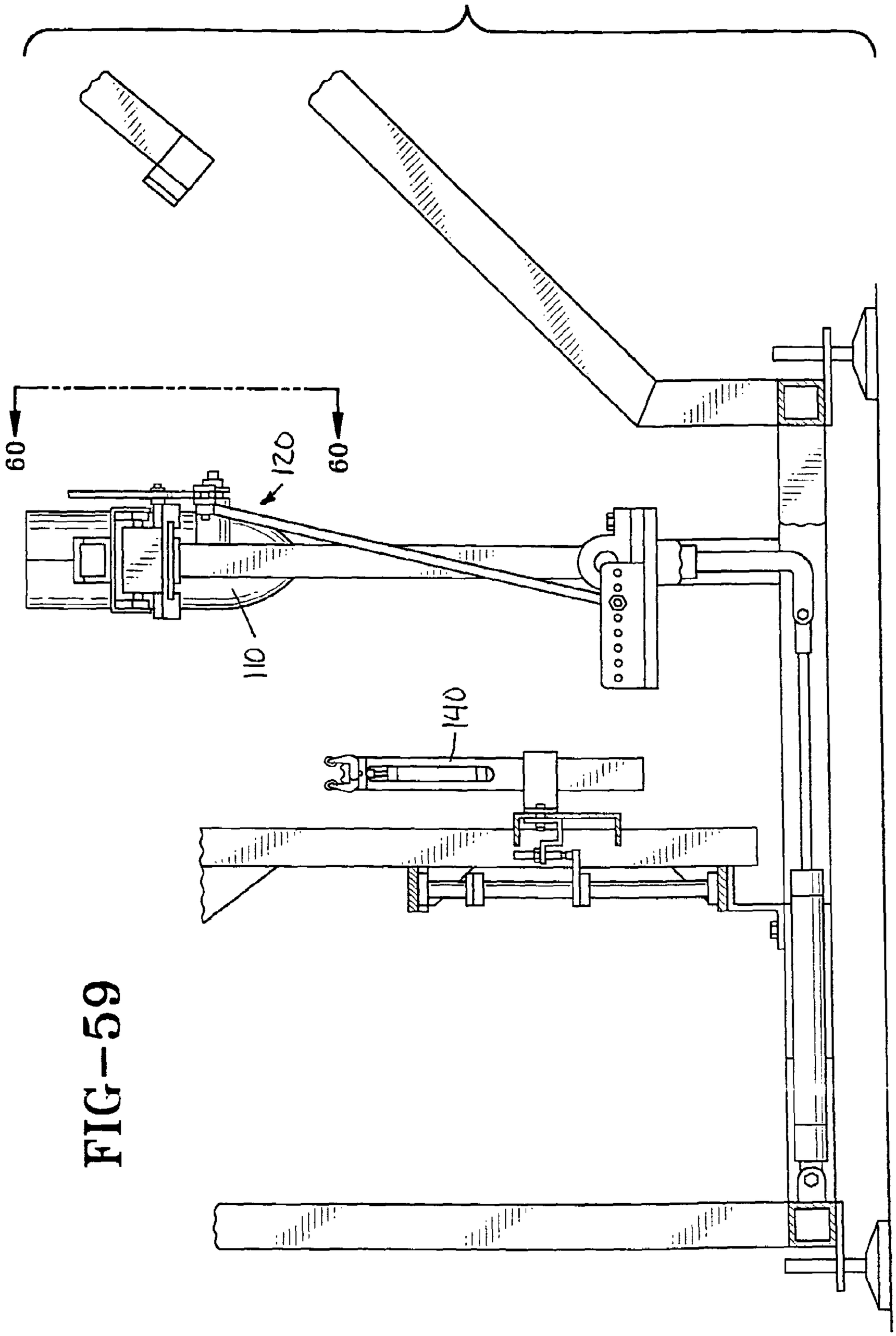


FIG-59

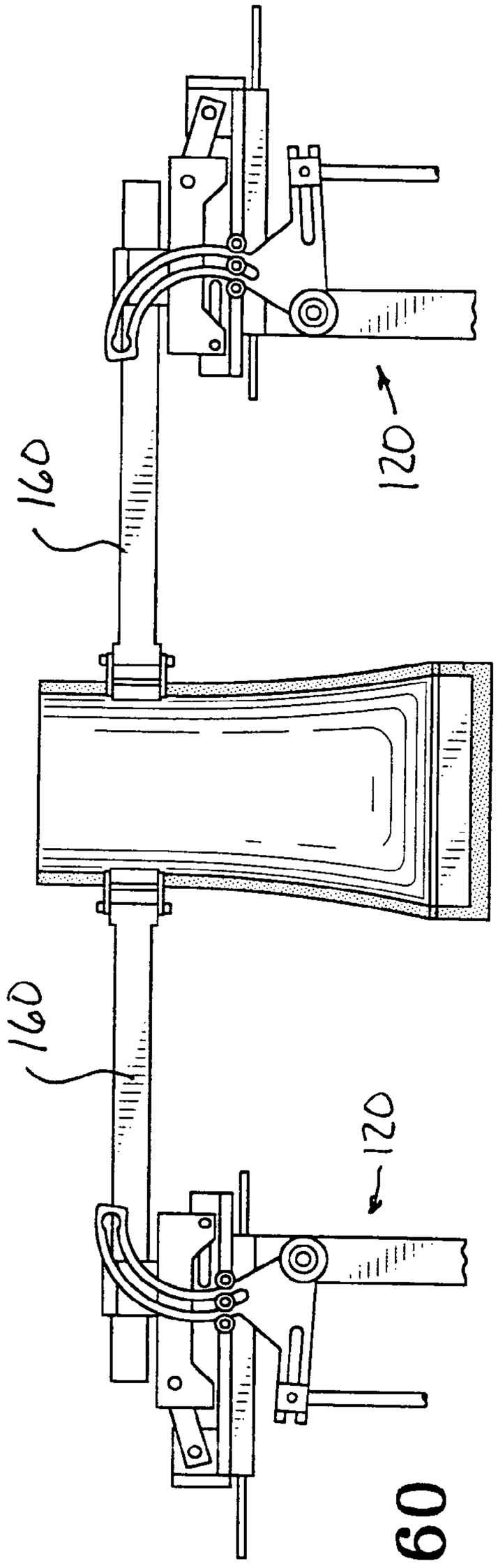


FIG-60

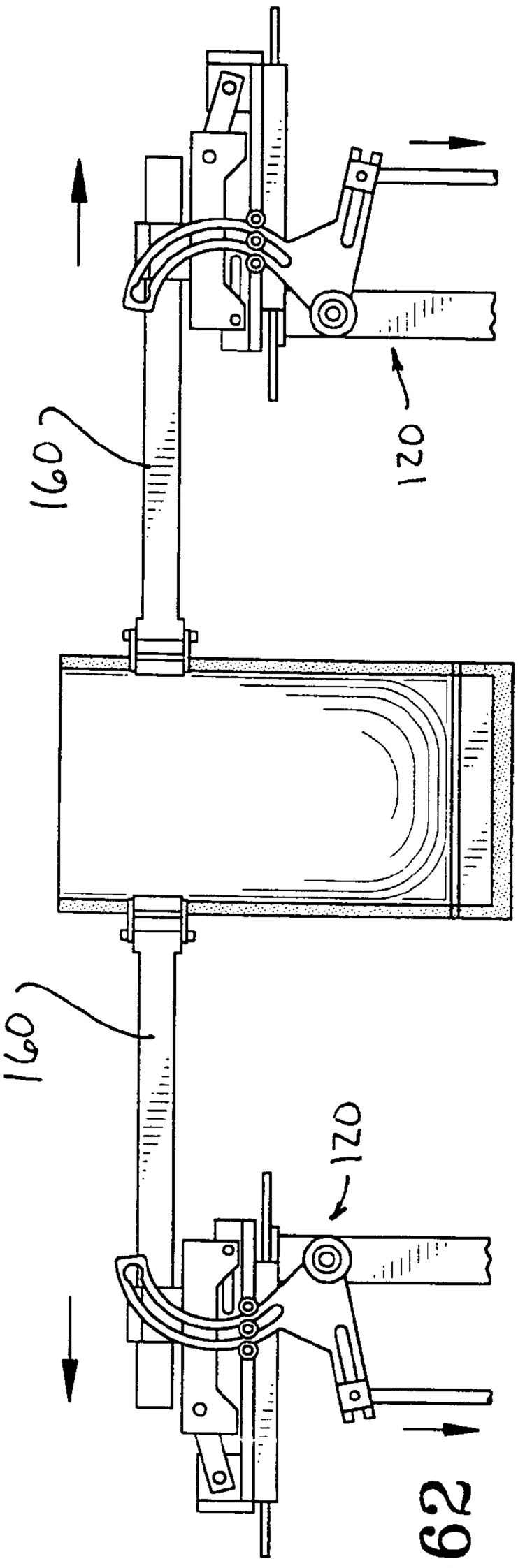


FIG-62

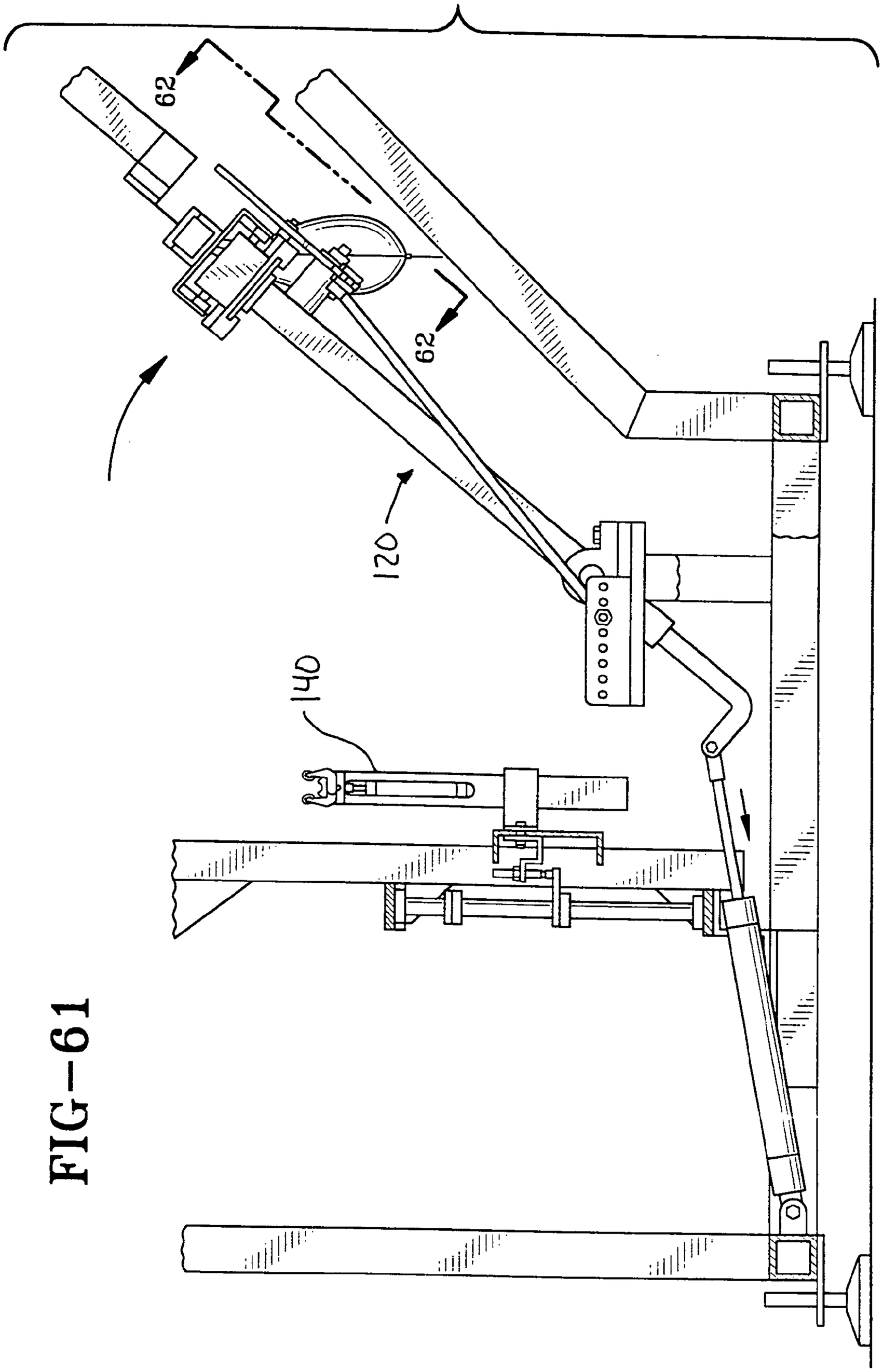


FIG-61

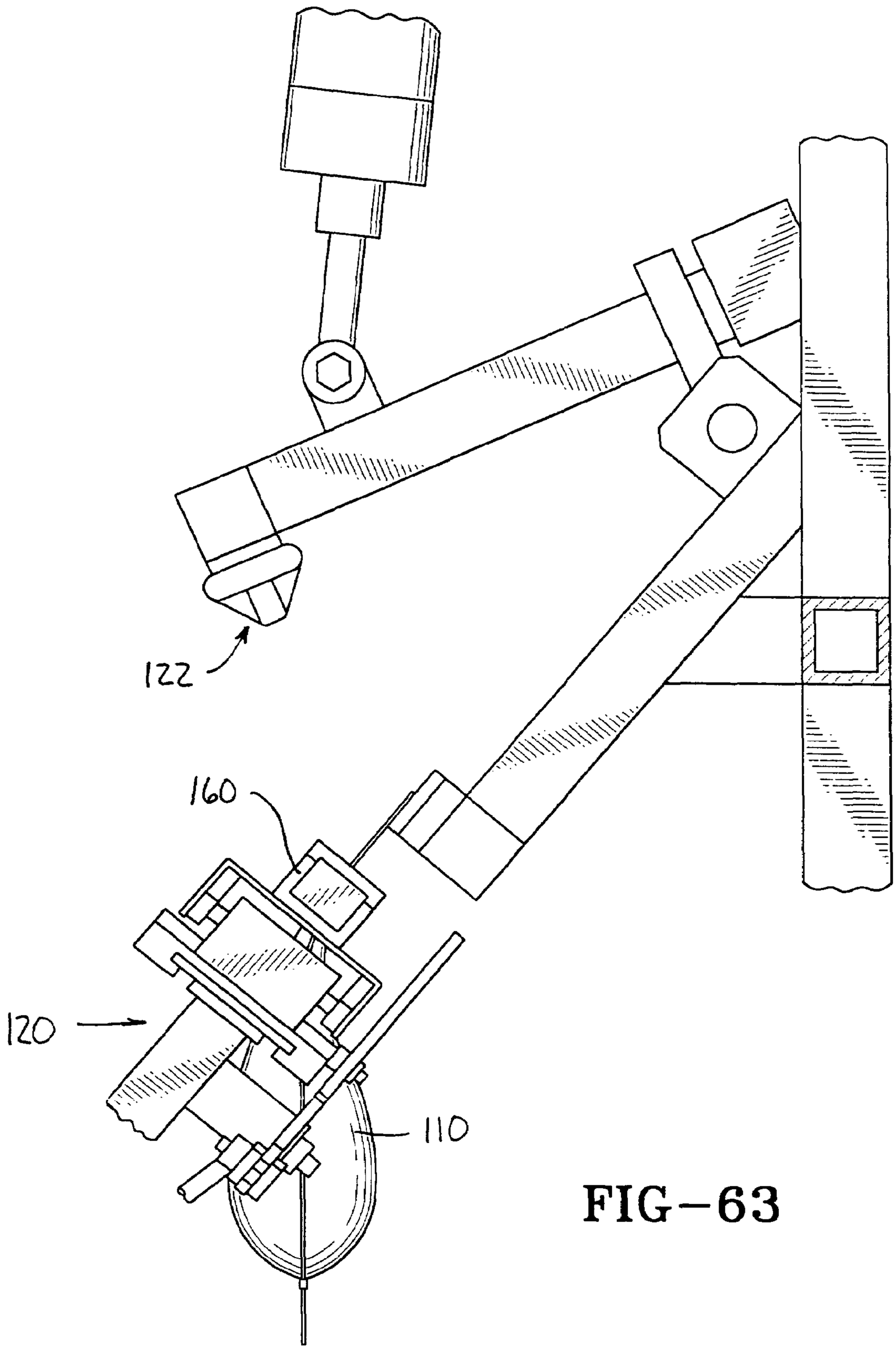


FIG-63

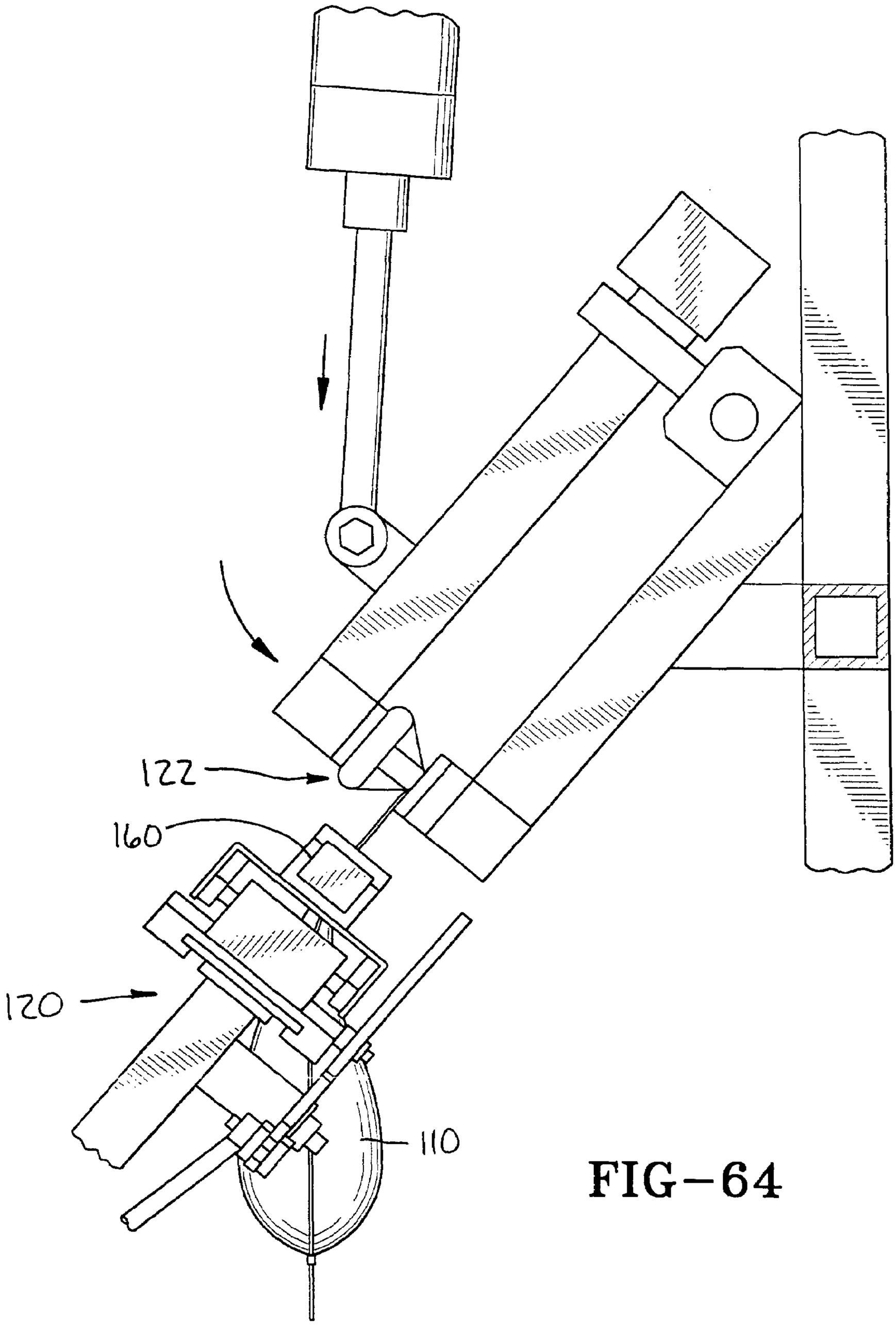


FIG-64

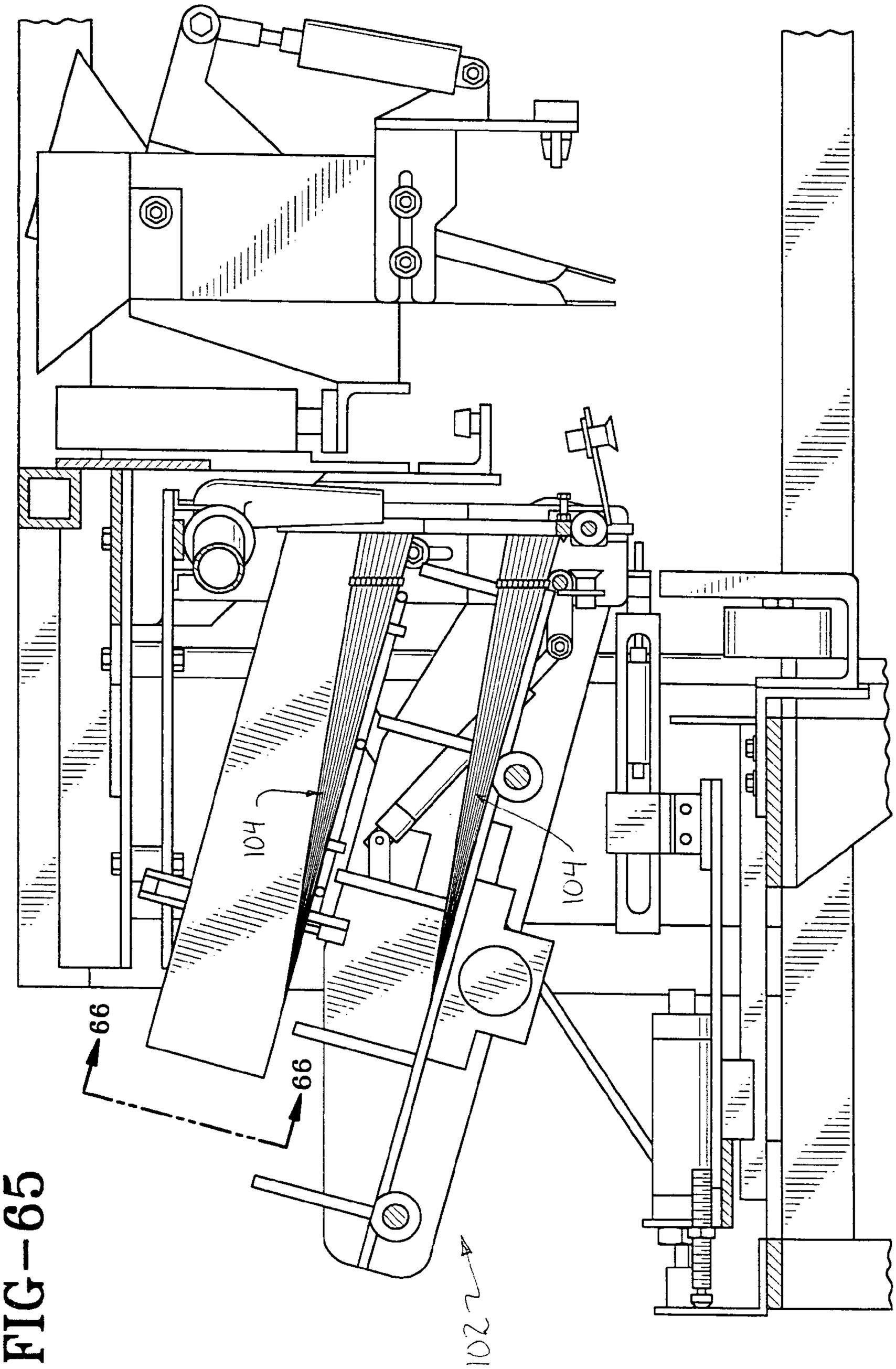


FIG-65

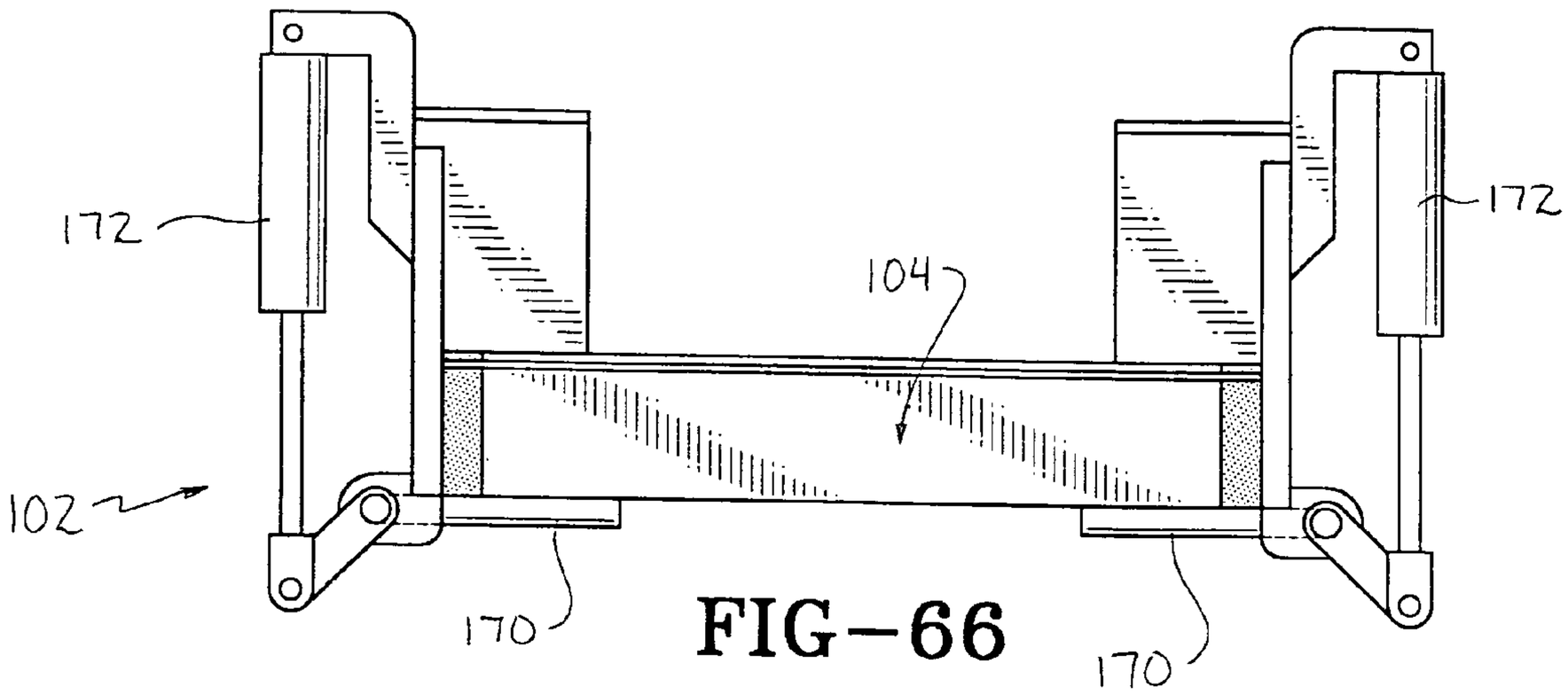


FIG-66

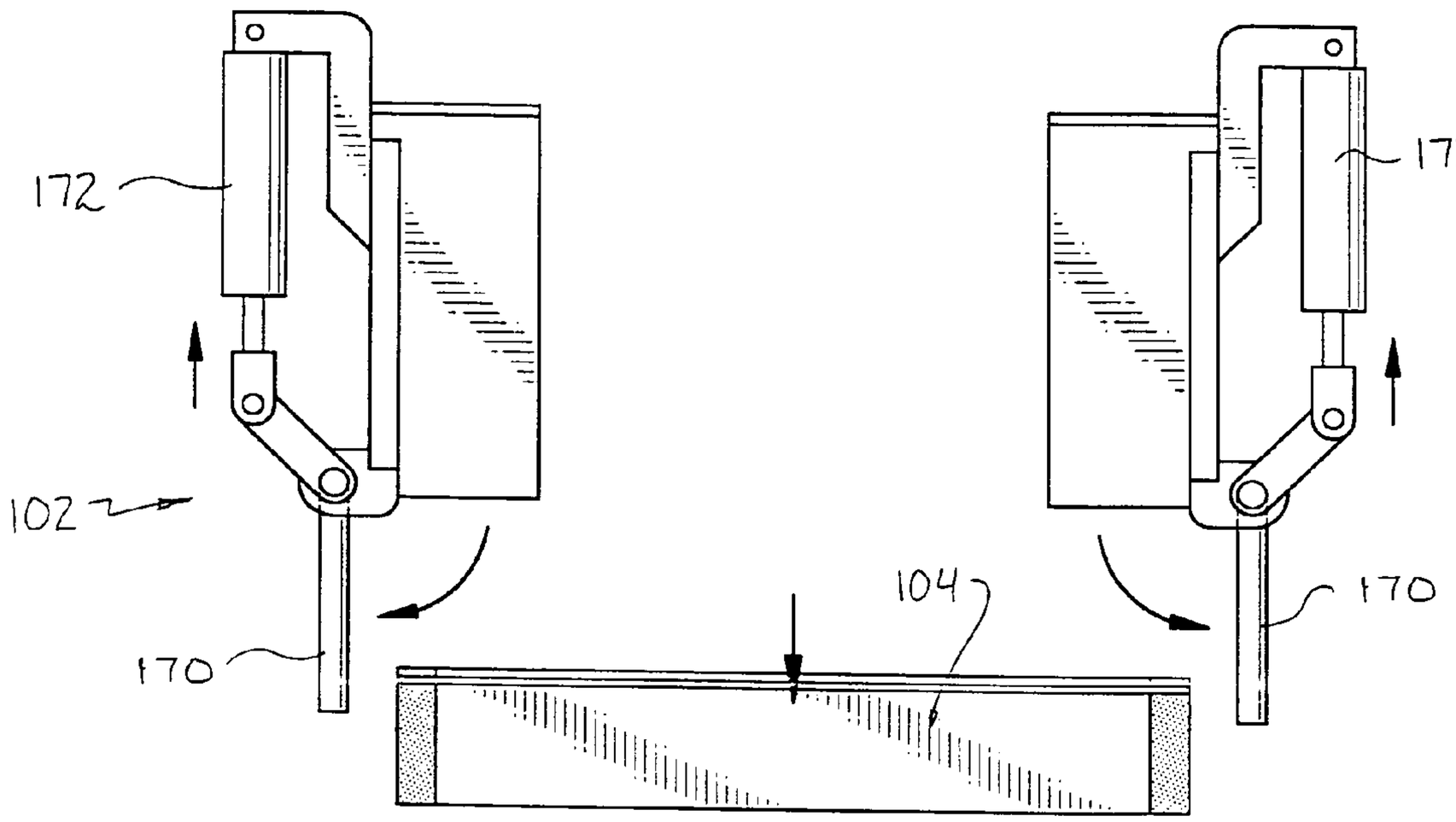


FIG-67

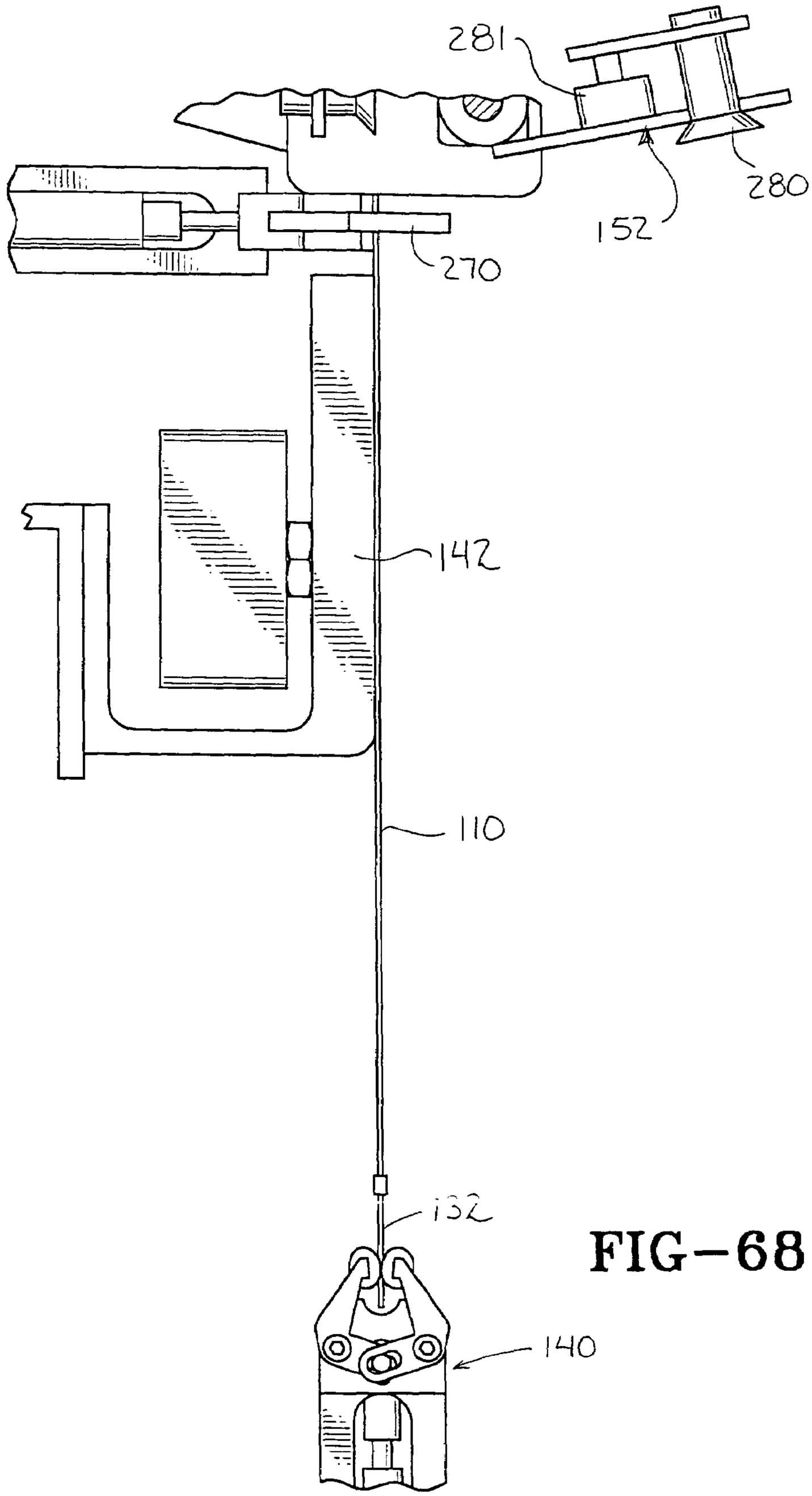


FIG-68

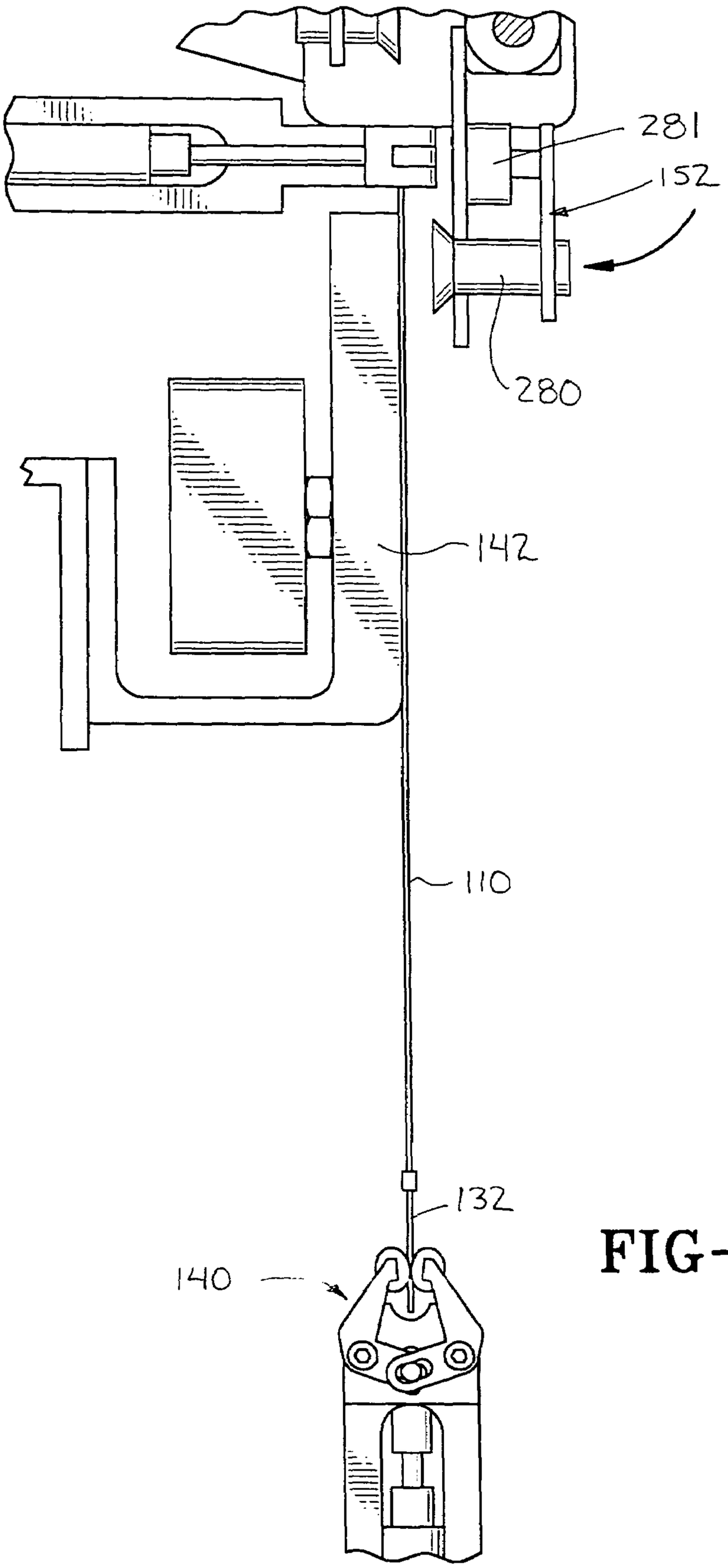


FIG-69

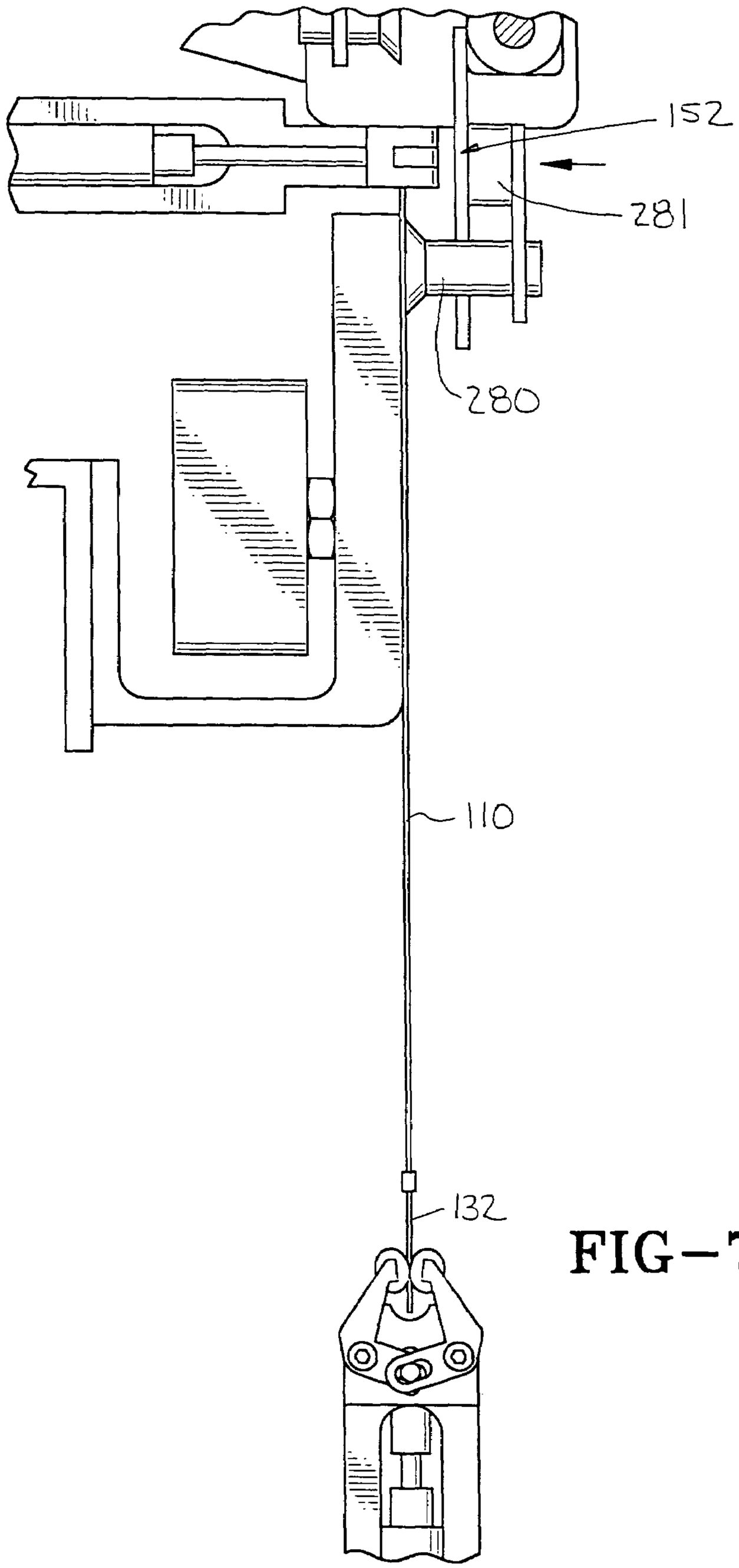


FIG-70

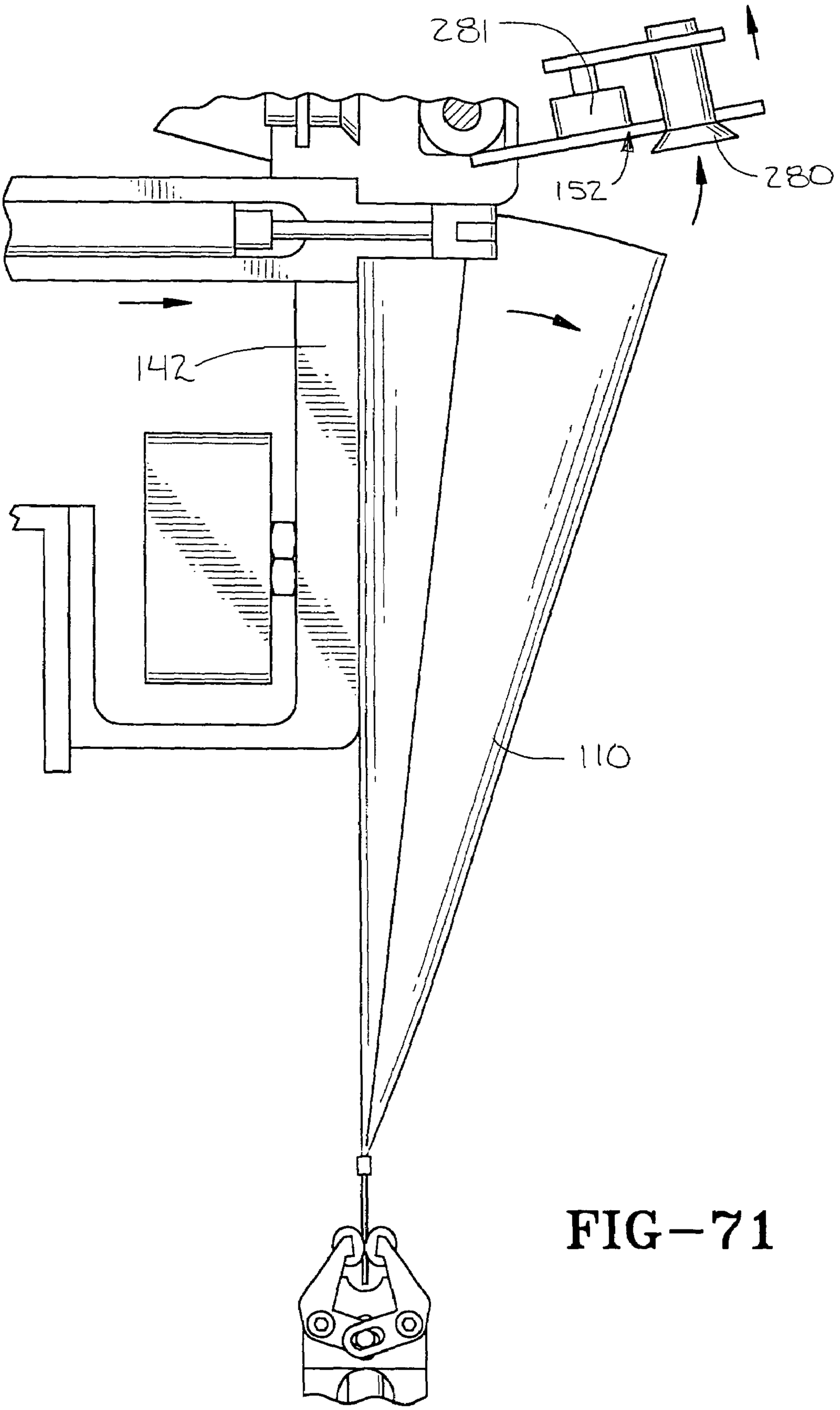


FIG-71

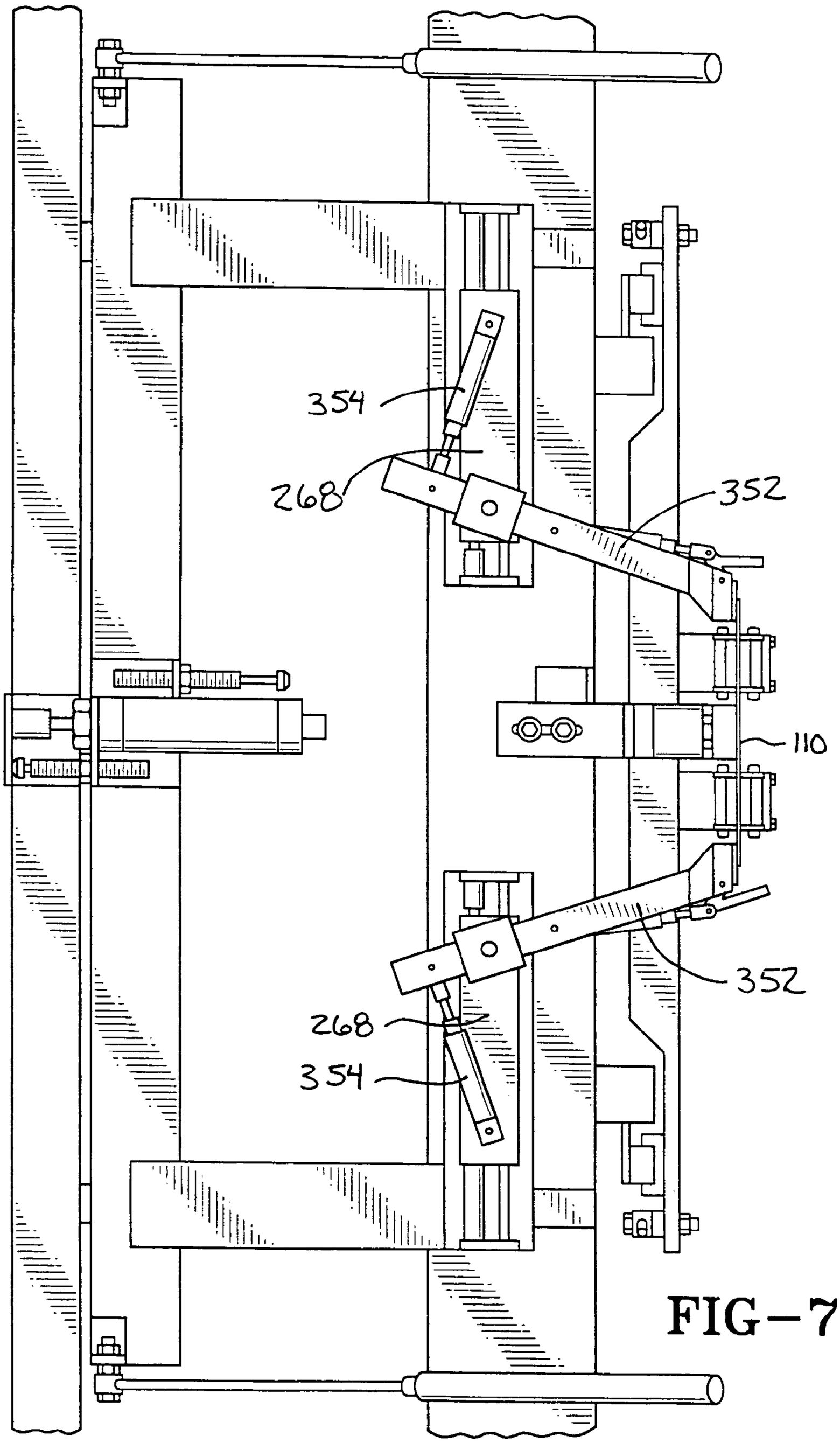


FIG-72

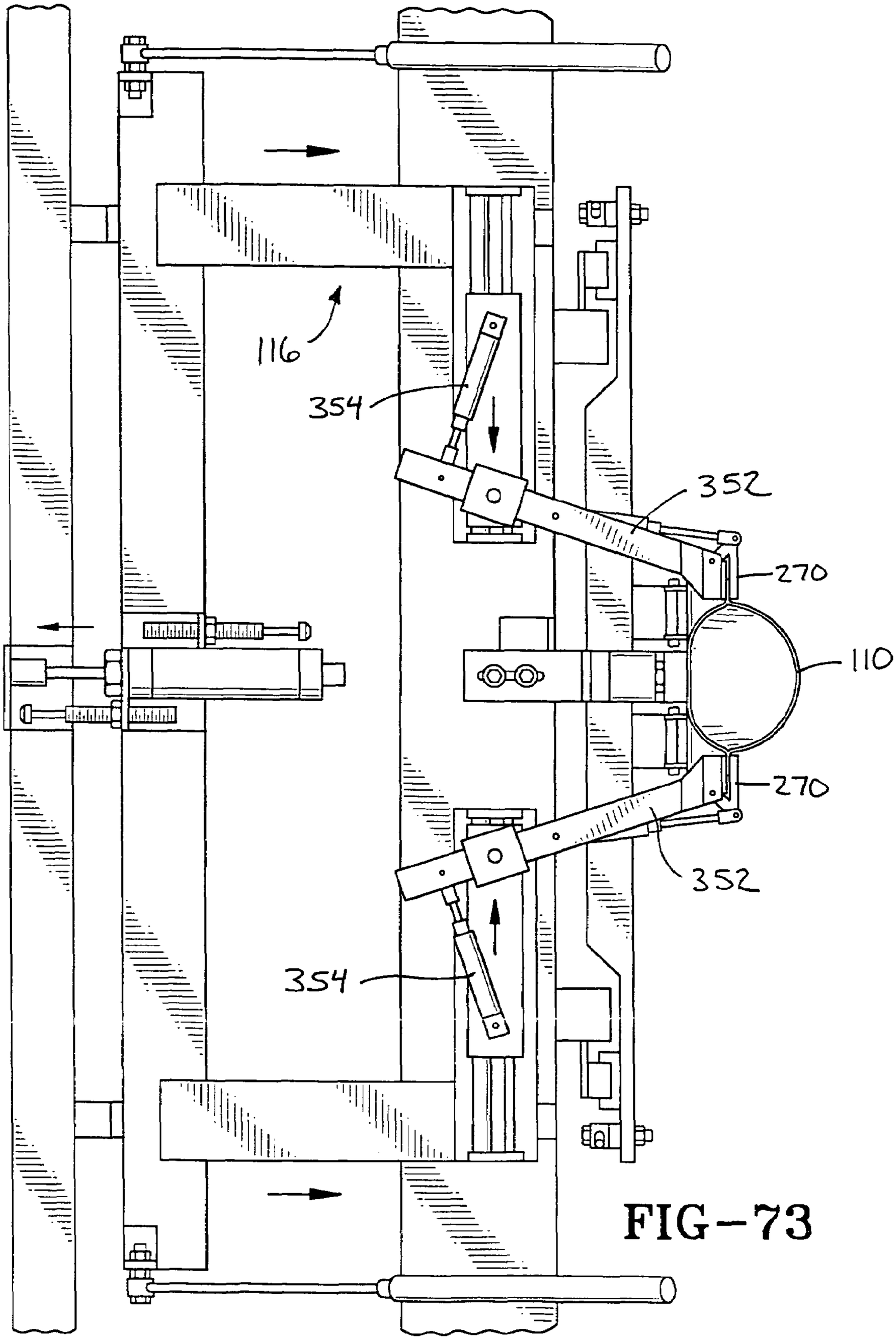


FIG-73

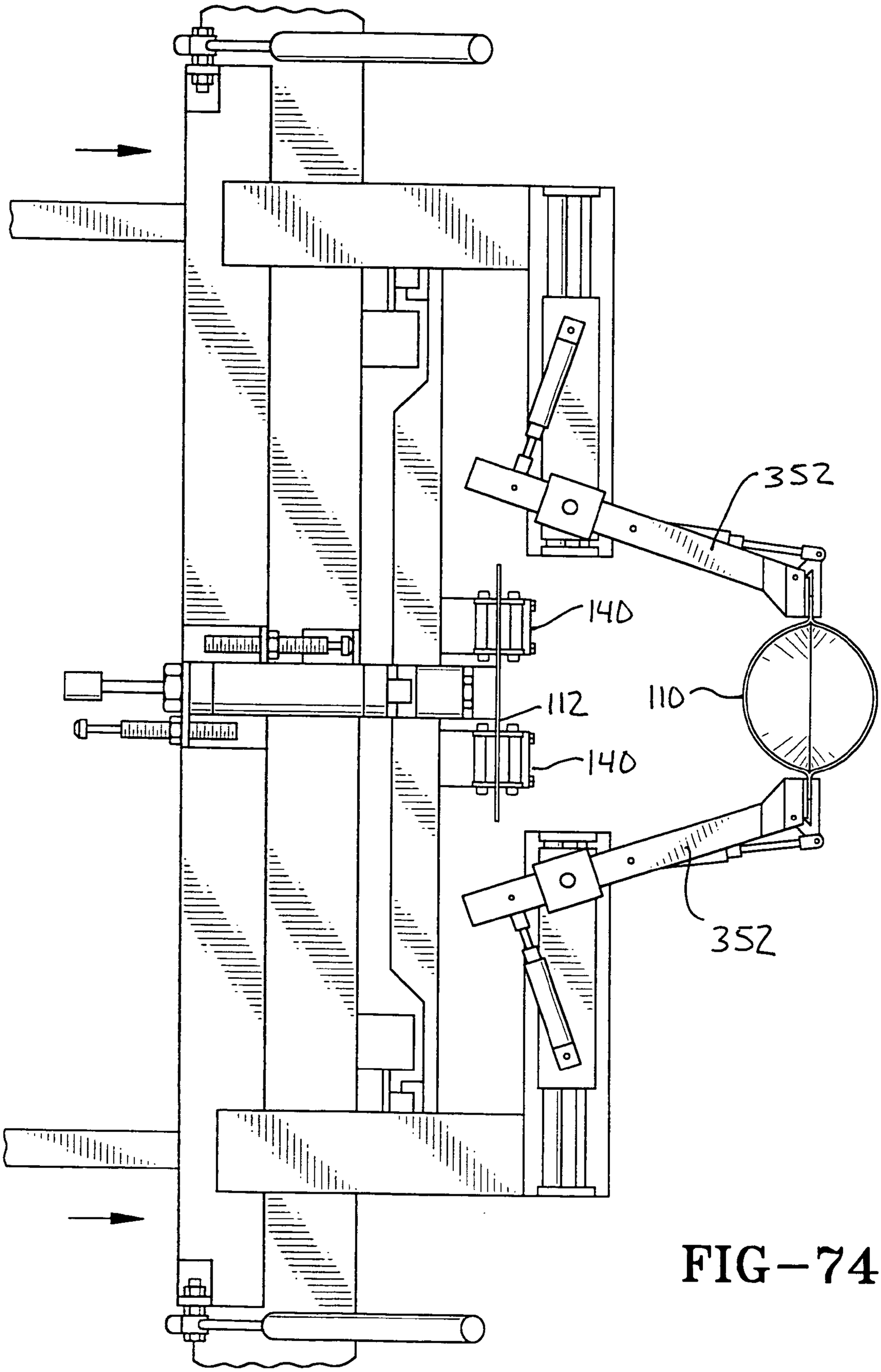


FIG-74

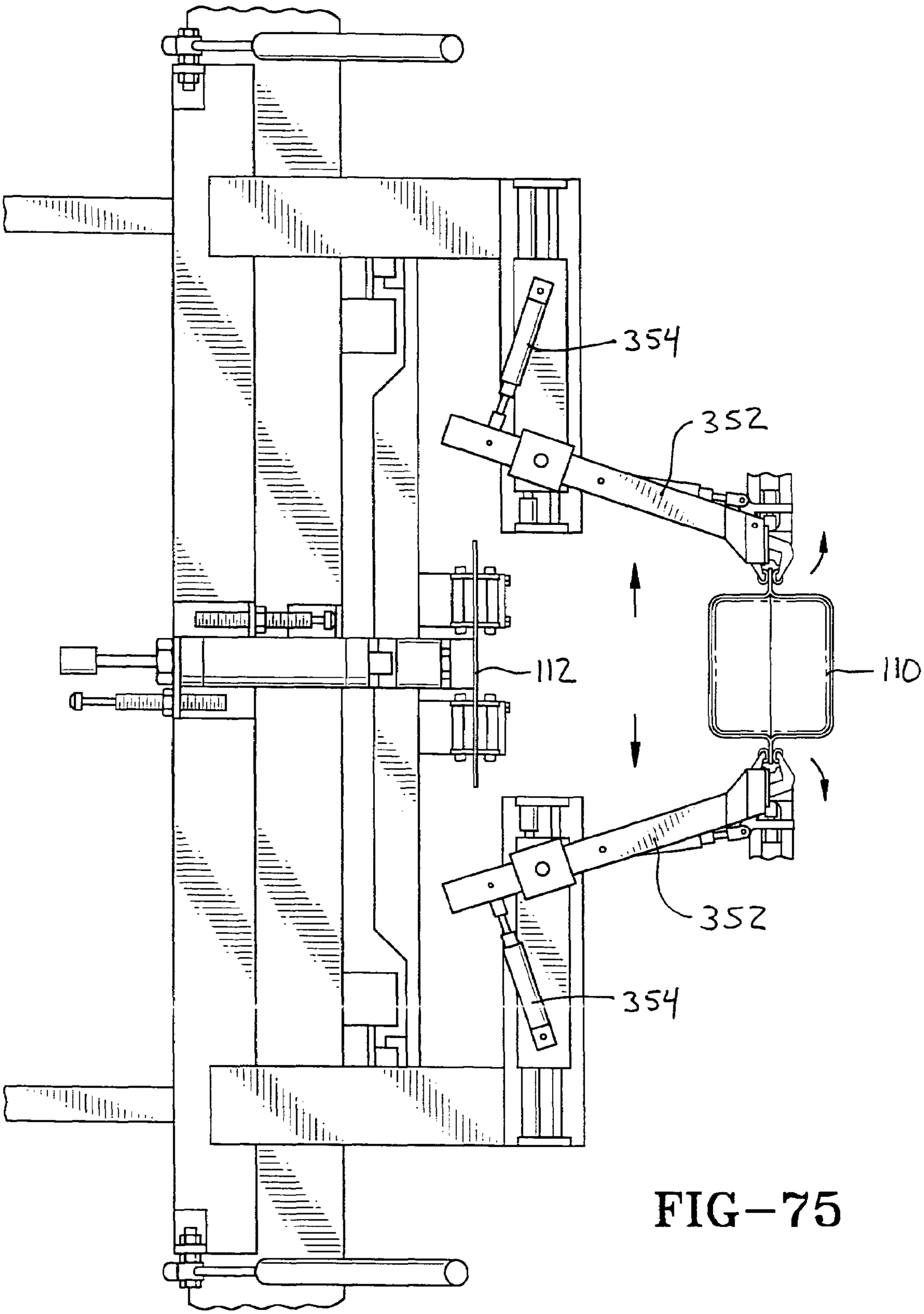


FIG-75

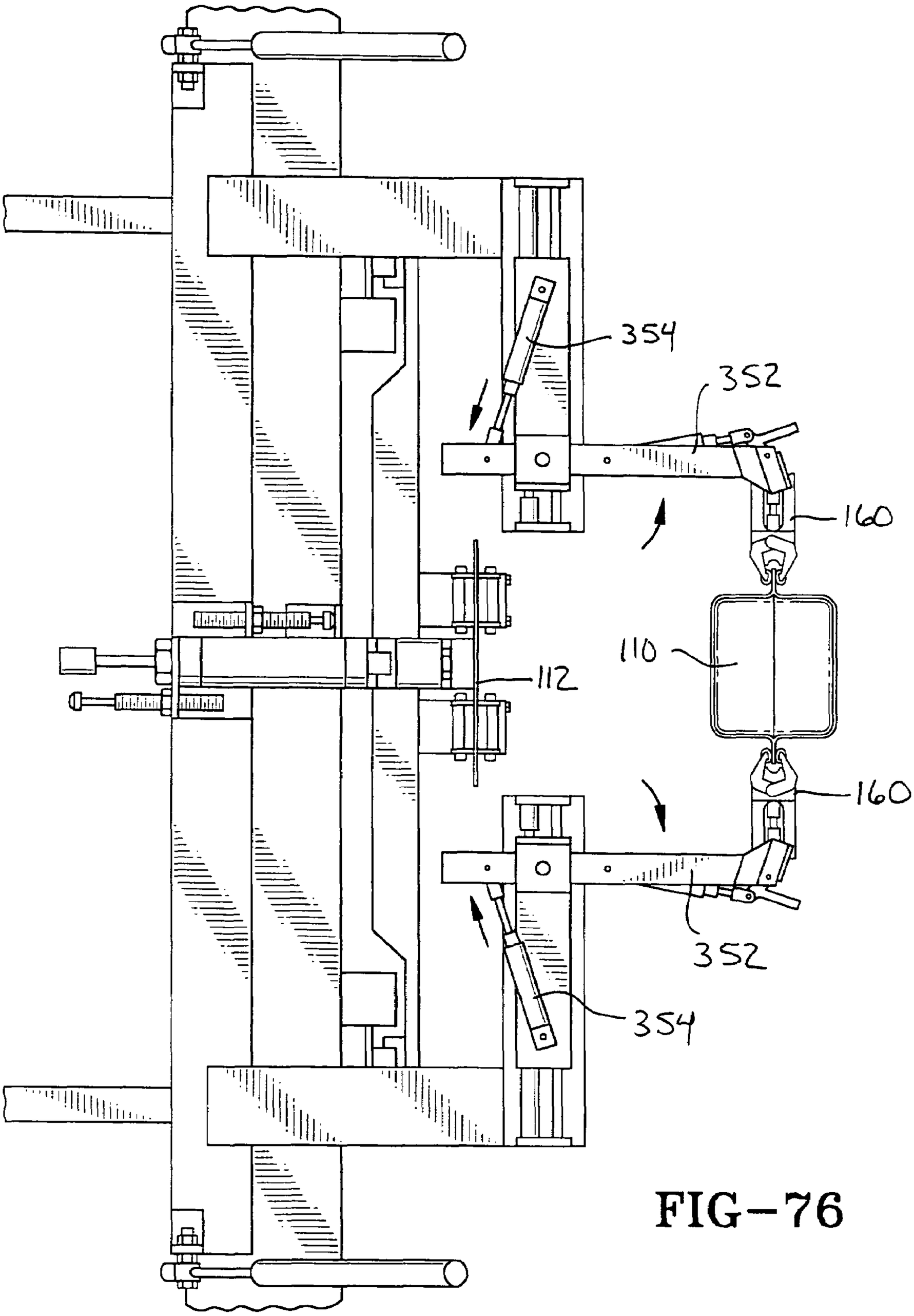


FIG-76

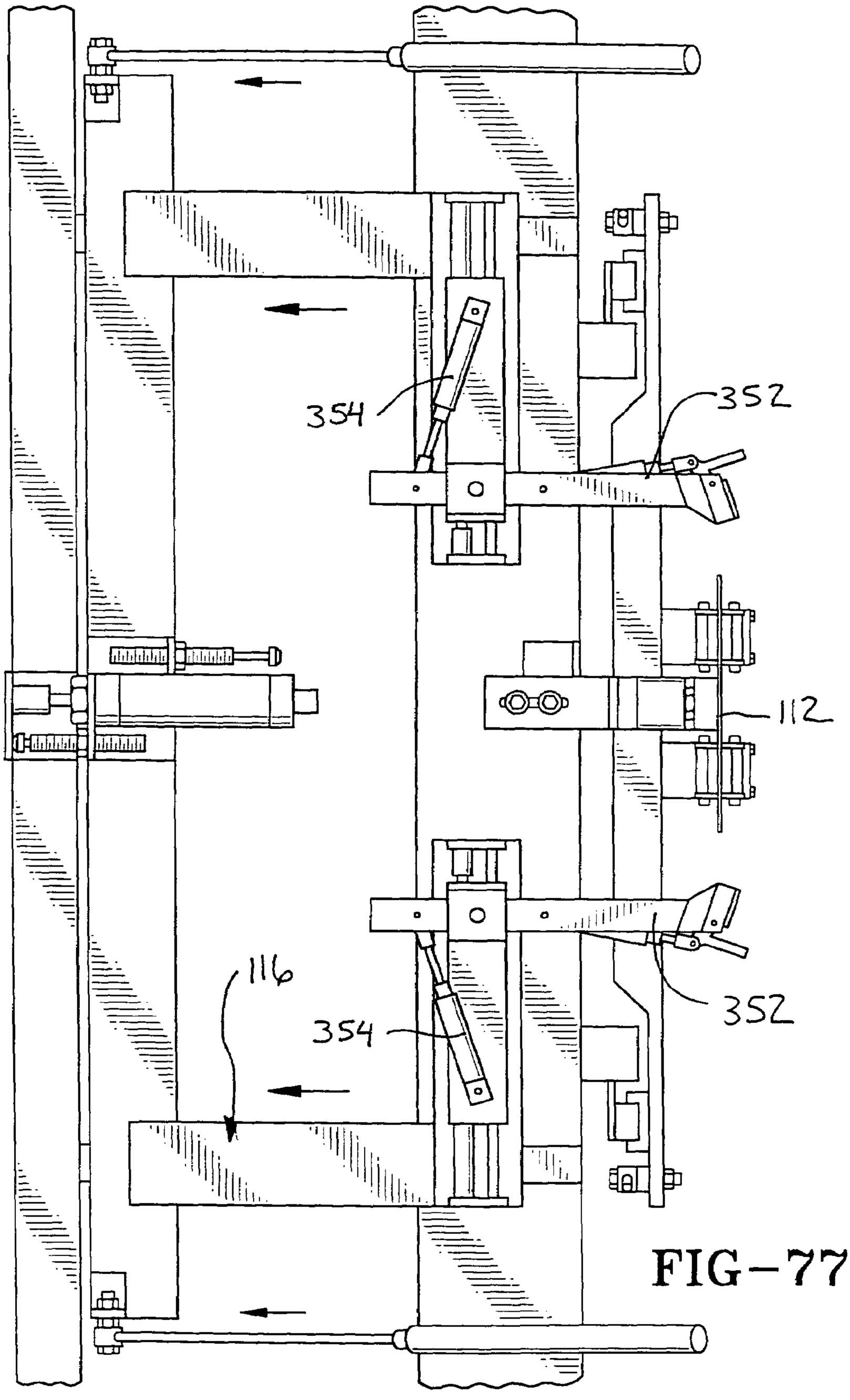


FIG-77

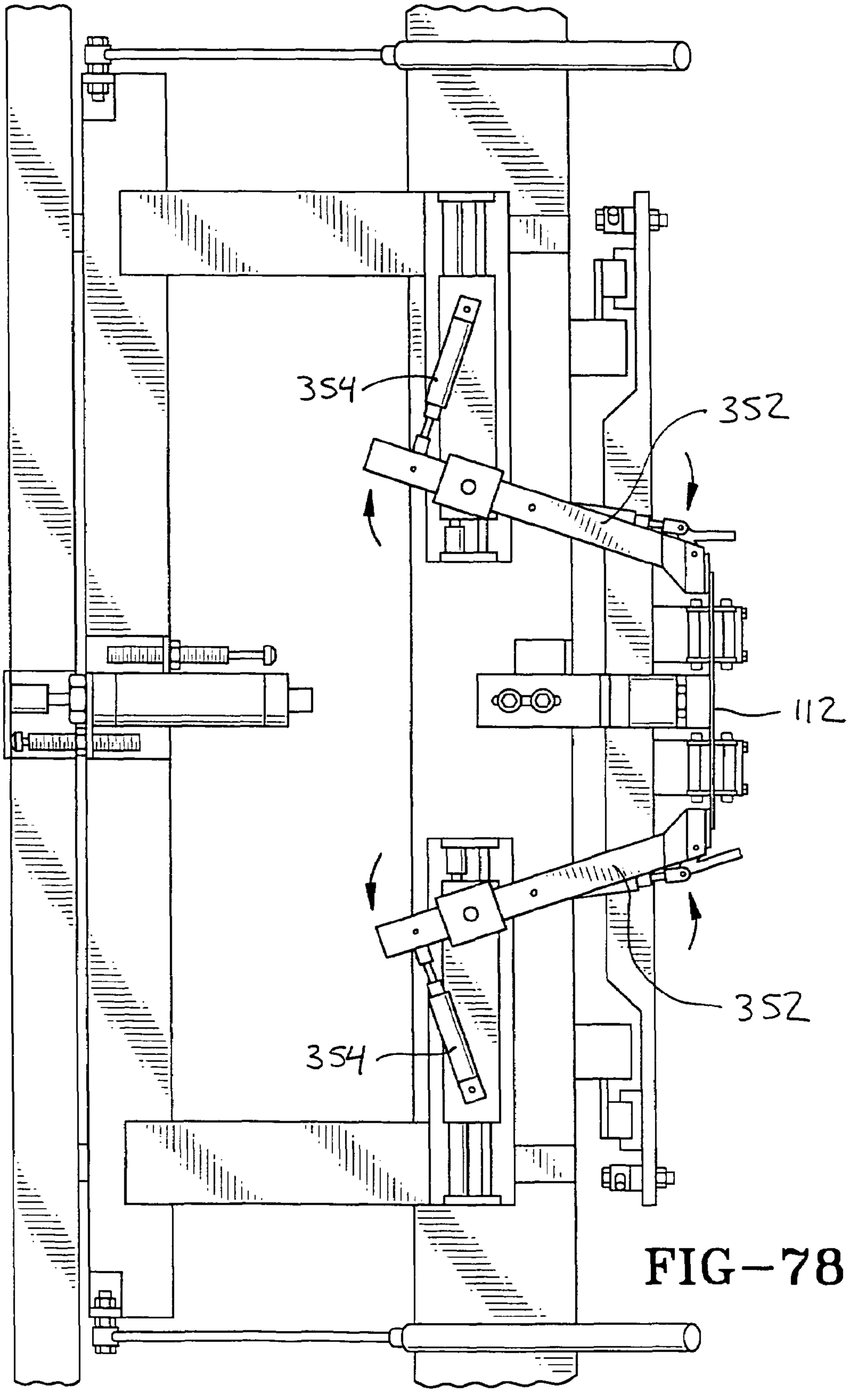


FIG-78

METHOD FOR REMOVING A POUCH FROM A PLURALITY OF POUCHES INCLUDING BENDING AND PULLING OF THE POUCH

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims priority from U.S. Provisional Patent Application Ser. No. 60/646,910 filed Jan. 25, 2005, and U.S. Provisional Patent Application Ser. No. 60/646,213 filed Jan. 22, 2005; the disclosures of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Technical Field

The present invention generally relates to methods and apparatus for handling pouches and, more particularly, to methods and apparatus for presenting empty pouches to be filled. Specifically, the present invention relates to a method and apparatus for reliably removing a single pouch from a stack of pouches.

2. Background Information

A wide variety of pouch handling apparatus are known in the art for performing different actions on empty, unsealed pouches. One class of these apparatus load empty, unsealed pouches into a filling a station, fill the pouches with product, and then seal the pouches. Loading empty, unsealed pouches into the pouch handling apparatus is a problem common to most apparatus. One solution is to require the pouches to be individually loaded by a worker. Although accurate, this method is expensive due to the cost of the worker and the lower throughput of the apparatus. Other apparatus receive empty pouches on pouch wickets. Wicketed pouches may be individually removed from the wicket by partially opening the front pouch and pulling the pouch from the wicket with grippers that pinch the sides or top of the pouch. Drawbacks with wicketed pouches include the cost of providing the pouches on the wicket and the waste generated when the flange having the wicket holes is discarded after the pouch is sealed. Pouch handling apparatus that avoid the waste of wicket flanges include those that receive empty, unsealed pouches in simple stacks held in a pouch magazine. Although these pouches are easy to provide and easy to load, those skilled in the art have been challenged by making reliable automated pouch removable mechanisms. Stacked pouches have a tendency to cling to one another (static electricity forces and/or intermolecular attractions) thus requiring mechanisms that overcome the problem of grabbing a single pouch instead of a plurality of pouches. Various prior art solutions exist for this problem. Although most are suitable for their intended purpose, room for improvement remains in the art.

Another problem with stacked pouches is the limited number of zipper pouches that can be stacked. The zippers substantially increase the thickness of one end of the pouch causing the stack of pouches to be wedge shaped. The wedge limits the total number of pouches that may be stacked. When these pouches are processed, a worker must continually load small wedges of pouches into the pouch magazine while the apparatus is running. Those who use these pouch apparatus thus desire a pouch magazine that can hold an increase number of pouch wedges.

BRIEF SUMMARY OF THE INVENTION

In one embodiment, the invention provides a method and apparatus for removing a single pouch from a plurality of adjacent pouches by bending an edge of the pouch away from the next adjacent pouch and sliding the pouch away from the plurality of adjacent pouches. In one configuration, the apparatus includes a magazine that holds the plurality of adjacent pouches and a pouch separator adapted to remove a single pouch at a time.

In another embodiment, the invention provides a method and apparatus for tensioning the pouch as it is removed from the plurality of adjacent pouches.

In another embodiment, the invention provides a method and apparatus that removes and positions the next successive pouch while the previous pouch is being loaded in order to increase pouch throughput while maintaining the compact overall dimensions for the apparatus.

In another embodiment, the invention provides a magazine for a plurality of adjacent pouches wherein the magazine automatically refills itself at least once.

In another embodiment, a method and apparatus are disclosed for readily setting up the apparatus for pouches of differing sizes.

One aspect of the invention is that each pouch is retained by at least two holding devices at different locations through the method and apparatus to maintain control over the position of the pouch and to reduce lost pouches.

These invention embodiments may be used individually or in combination to provide methods and apparatus.

DISCLOSURE OF THE INVENTION

FIG. **1** is a flow chart showing the general steps performed by one embodiment of the apparatus of the invention.

FIG. **2** is side elevation view of one embodiment of the apparatus of the present invention.

FIG. **3** is a rear elevation view shown from the right side of FIG. **2**.

FIG. **4** is side view of the front of the pouch magazine with the pouch separation arm in a first position.

FIG. **5** is a view similar to FIG. **4** with the pouch separation arm in a second position.

FIG. **6** is a view similar to FIG. **4** with the pouch separation arm back in the first position having separated a pouch from the stack of pouches.

FIG. **7** is a view similar to FIG. **4** showing a pouch removal arm in a second position grabbing the separated pouch.

FIG. **8** is a side view showing the pouch removal arm moving from the second position toward its first position to pull the pouch to a pouch holder.

FIG. **9** is a view similar to FIG. **8** showing the pouch completely removed from the pouch stack and held by the pouch holder.

FIG. **10** is a view similar to FIG. **9** showing an opening arm moved to its second position to engage the pouch.

FIG. **11** shows the pouch being opened with the opening arm.

FIG. **12** shows the pouch being opened with air.

FIG. **13** is a side view showing the loading funnel.

FIG. **14** is a side view showing the opened pouch presented to the loading funnel.

FIG. **15** is a side view showing the loading funnel inserted in the pouch while the pouch is still held by the pouch holder.

FIG. **16** is a side view showing the loading funnel opened in the pouch while the pouch is still held by the pouch holder.

FIG. **17** shows the retraction of the pouch holder.

FIG. **18** shows the retraction of the loading funnel.

FIG. **19** shows the delivery of the loaded pouch to the sealer.

FIG. **20** shows the loaded pouch being sealed.

FIG. **21** is a side view of the pouch magazine, the pouch shuttle, and the loading device.

FIG. **22** is a front view of the pouch magazine.

FIG. **23** is a top view of the pouch magazine shown adjusted for a first size pouch.

FIG. **23**A is a top view of the pouch magazine shown being adjusted for a second size pouch that is wider than the first size.

FIG. **24** is a top view of the pouch magazine shown with a plurality of pouches loaded into the magazine.

FIG. **25** is a side view similar to FIG. **21** showing the plurality of adjacent pouches loaded into the pouch magazine.

FIG. **26** is an enlarged side view of the front of the pouch magazine showing the first pouch engaging the static stop.

FIG. **27** is an enlarged side view of the front of the pouch magazine showing the separation device engaging the first pouch.

FIG. **28** is an enlarged side view of the front of the pouch magazine showing the separation device bending the front edge of the first pouch over the mandrel to form a bent edge of the first pouch.

FIG. **29** is a rear view of the apparatus showing the pull down device adjusted for a first size pouch.

FIG. **29**A shows the pull down device being adjusted for a second size pouch wider than the first size pouch.

FIG. **30** is a section view taken along line **30-30** of FIG. **29** showing the height adjustment stop than limits how far down the pull down device moves when removing the first pouch from the plurality of adjacent pouches.

FIG. **31** is a section view taken along line **31-31** of FIG. **29** showing the adjustment stop in a first position for a first size pouch.

FIG. **31**A is a view similar to FIG. **31** showing the adjustment stop in a second position for a second size pouch having a length shorter than the first size pouch.

FIG. **32** is a view similar to FIG. **28** showing the pull down device moved up to a first position where it engages the bent edge of the first pouch.

FIG. **33** is a rear view of the pull down device in the first position shown in FIG. **32**.

FIG. **34** is a view similar to FIG. **32** showing the first pouch being pulled over the mandrel and the tensioning device to remove the first pouch from the plurality of adjacent pouches.

FIG. **35** shows the first pouch completely removed.

FIG. **36** is a rear view of FIG. **35**.

FIG. **37** is a top view of the shuttle in a first position where the shuttle arms are ready to grasp opposite portions of the first pouch.

FIG. **37**A is a view similar to FIG. **37** showing the shuttle being adjusted for a second size pouch wider than the first size pouch.

FIG. **38** is a top view of the shuttle arms positioned with respect to the first pouch.

FIG. **39** is a side view of one shuttle arm grasping a portion of the first pouch.

FIG. **40** is a top view of the shuttle arms grasping opposite portions of the first pouch.

FIG. **41** is an enlarged side view of the top of the first pouch while it is held by the shuttle arms and with its first side engaged by the tensioning device with the bag opener in a first position.

FIG. **42** is a view similar to FIG. **41** showing the bag opener in a second position engaged with the second side of the first pouch.

FIG. **43** shows the first pouch being opened with a blast of air from an overhead air knife and the movement of the bag opener from the second position to the first position. FIG. **43** also shows the optional step of having the shuttle arms moving forward to an intermediate position to help open the pouch. The opening step may occur in the position as shown in FIG. **43** or in an intermediate shuttle position on its way to the loading position so that the second pouch may be pulled down while the first pouch is being opened. This configuration may be used to increase the throughput of the apparatus.

FIG. **44** is a top view of the shuttle arms moving inwardly to help open the first pouch.

FIG. **45** is a rear view of the shuttle arms moving inwardly to help open the first pouch.

FIG. **46** is a view similar to FIG. **43**.

FIG. **47** is a view similar to FIG. **21** showing the fist pouch opened and held by the shuttle.

FIG. **48** shows the opened first pouch being moved to the loading position.

FIG. **49** shows the opened first pouch being moved to the loading position.

FIG. **50** shows the first pouch at the loading position with the transfer arms in their first position.

FIG. **51** shows the funnel moved into its loading position.

FIG. **52** shows the funnel being opened.

FIG. **53** shows the funnel being moved down into the first pouch.

FIG. **53**A shows the transfer arm mechanism.

FIG. **54** shows the transfer arms moved up to engage the first pouch.

FIG. **54**A shows the transfer arm mechanism being moved.

FIG. **55** is a top view of the shuttle and the transfer arms holding the first pouch.

FIG. **56** is a top view showing the shuttle released from the first pouch.

FIG. **57** is a side view showing the first pouch being filled. In an alternative embodiment, the second pouch would be being pulled down or would be being opened at this stage to increase throughput.

FIG. **58** shows the funnel being disengage from the first pouch.

FIG. **59** is a side view of the transfer mechanism.

FIG. **60** is a view taken along line **60-60** of FIG. **59**.

FIGS. **61-64** show the process of transferring the first pouch to the sealer and sealing the first pouch.

FIG. **62**A shows the transfer arm mechanism moving back.

FIGS. **65-67** show a new pouch magazine showing first and second pluralities of adjacent pouches wherein the second plurality of adjacent pouches drop down to the first position after all of the first pouches are used.

FIGS. **68-71** show an alternative suction device used to open the top of the pouch.

FIGS. **72-78** show an alternative method used to increase throughput by pulling the second pouch down to the ready position while the first pouch is being opened and filled.

Similar numerals refer to similar parts throughout the drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The pouch handling apparatus of the present invention is indicated generally by the numeral **100** in the accompanying drawings. Apparatus **100** provides an exemplary apparatus of how the apparatus and methods of the present invention may be used in combination. Other apparatus may also be used to perform the methods described and claimed in this application. The exemplary apparatus **100** generally includes a pouch magazine **102** that holds a plurality of adjacent pouches (a stack of pouches) **104** in a ready position. These pouches do not necessarily include wicket rod holes and the pouches are stacked on top of each other when delivered to the location where each pouch will be filled and sealed. Plurality of adjacent pouches **104** is wedge-shaped when the pouches include a closure device **106**. Apparatus **100** also includes a pouch separator **108** that cooperates with magazine **102** to remove only the first pouch **110** from plurality of adjacent pouches **104** without upsetting the position of the second pouch **112** so that second pouch **112** may be properly positioned as the first pouch for the next pouch separation action of separator **108**. Apparatus **100** further includes a pouch opener **114** and a shuttle **116** that moves pouches to a filling station **118** and a transfer arm mechanism **120** that moves filled pouches to a sealer **122**.

The method for removing first pouch **110** from plurality of adjacent pouches **104** is generally described with reference to FIGS. **4-9**. FIGS. **4** and **5** show a separation arm **130** that engages a first body portion such as an edge **132** of first pouch **110** in order to pivot or bend the first body portion away from second pouch **112** about an axis as shown in FIG. **6**. The axis is disposed intermediate the outer edges of the second pouch. For the purpose of separating the pouches, edge **132** may be any of the edges of the pouches. In the exemplary apparatus **100**, edge **132** is adjacent closure **106** opposite from the open end of the pouch that is used to fill pouch. Bending this edge allows the spacing created by closure **106** to help separate the pouches. Bending edge **132** away from the reference plane defined by second pouch **112** allows most joining (e.g. static, cohesion, intermolecular) forces between first **110** and second **112** pouches to be overcome without significant movement or manipulation of second pouch **112**. This method is also described as peeling edge **132** of first pouch **110** from second pouch **112**. The axis about which the edge is bent is disposed parallel to the reference plane. In one configuration, edge **132** should be bent at least 30 degrees from the reference plane of second pouch **112** to ensure good separation. The leading end **134** of first pouch **110** may be pulled over a static stop **136** that helps prevent second pouch **112** from bending with first pouch **110** to the bent position of FIG. **6**. Applying a vibrational force to magazine **102** may also help position pouches **110** and **112** within magazine **102**.

FIGS. **7-9** show the next step wherein first pouch is pulled out from under second pouch **112** by a pouch removal arm **140** that pulls pouch **110** in a direction nonparallel to the reference plane of the second pouch. As first pouch **110** is pulled out of magazine **102**, the body of pouch **110** remains in its own reference plane until the body reaches the edge **138** (edge **138** may be a curved mandrel or a portion of separation arm **130**) over which edge **132** is bent. Any forces imparted to second pouch **112** during the removal of first pouch **110** are counteracted by the supports of magazine **102** which are disposed around the sides of second pouch **112** to hold it in position. As first pouch **110** is pulled from magazine **102**, it slides over a pouch holder **142** that helps maintain the upright configuration of first pouch **110** so that it may be engaged by shuttle **116**. Holder **142** may hold pouch **110** in its upright position by applying a vacuum flow to first pouch **110**.

FIGS. **10-12** show pouch **110** being opened. Opposite portions of pouch **110** are first engaged by shuttle arms **150**. An opening arm **152** then engages the front of pouch **110** as shown in FIG. **10** and moves away from pouch **110** as shown in FIG. **11** to pull open pouch **110**. Opening arm **152** may apply a vacuum force to pull pouch **110** open. In addition, an air knife **154** may direct a burst of air **156** (FIG. **12**) to help open pouch **110**. While moving away, arm **152** releases pouch **110** and moves out of the way so that open pouch **110** may be transferred to filling station **118**. Arms **150** may move out from their initial position as shown in FIG. **12** to help open pouch **110**. These opening steps may occur directly below the pull down location for pouch **110** that is shown in the drawings. In an alternative embodiment, pouch **110** is moved forward from the pull down location with arms **150** so that second pouch **112** may be pulled down by arm **140** while pouch **110** is being opened and filled.

FIGS. **13-18** show one configuration of how pouch **110** is moved to filling station **118** and filled with the product that is being placed in pouch **110**. In other configurations, pouch **110** may be moved laterally to the configuration depicted in the exemplary drawings. Shuttle **116** moves open pouch **110** to a location below a funnel **158** disposed at filling station **118**. A pair of transfer arms **160** move in and engage opposite portions of pouch **110** while pouch **110** is still engaged by shuttle arms **150** as shown in FIG. **14**. Funnel **158** then moves into open pouch **110**, pivots open, and product is loaded into pouch **110**. Once pouch **110** is held by both funnel **158** and arms **160**, shuttle **116** releases pouch **110** and moves back to pick up second pouch **112** as shown in FIG. **17**. In the alternative embodiment, second pouch **112** has been pulled down from magazine **102** and is ready to be engaged by shuttle **116**.

As shown in FIGS. **18-20**, funnel **158** is then removed from pouch **110** and transfer arm mechanism **120** moves filled pouch **110** to sealer **122** wherein pouch **110** is sealed.

FIGS. **21-25** show the structure of magazine **102** and how magazine **102** may be adjusted to hold different-size pouches. As shown in FIG. **22**, magazine **102** includes a lower support **200**, a front support **202**, and a pair of lateral supports **204**. Each support **200**, **202**, and **204** may include a plurality of spaced support elements that minimize friction between pouches **104** and magazine **102** while also allowing a user's fingers to easily access the inside of magazine **102**. Lateral supports **204** are adjustable with respect to front support **202** so that magazine **202** may be adjusted from different-size pouches as shown in FIG. **23**A. Lateral supports **204** may be selectively, slidably supported on rods **206** that are, in turn, supported by a magazine frame **208**. Rods **206** may include markings or stops that allow a user to readily set up magazine **102** for a pouch size that matches the markings or stops on rods **206**. Magazine frame **208** is supported from the frame **210** of apparatus **100** with resilient members **212** that allow frame **208** to vibrate. A vibrator **214** carried by magazine **102** is used to impart the vibrational force to magazine **102**. Each lateral support **204** may include a portion of lower support **200** with those portions moving with lateral supports **200** so that the lateral edges of pouches **104** are supported in every adjustment position of magazine **102**.

Static stops **136** may be disposed at the lower end of front support **202**. The position of each stop **136** is adjustable with

respect to front support **202** so that the force required to overcome stops **136** may be tuned for different pouch stiffnesses.

The structure and operation of pouch separator **108** is shown in FIGS. **25-28**. Exemplary pouch separator **108** includes at least one suction cup **220** carried by a pivot rod **222**. Devices other than a suction cup **220** may also be used to bend edge **132** down. Such devices include adhesive pads, fingers that slide over the edge to push the edge down, and pinchers that pinch the edge to bend it down and then pull it down. Rod **222** is driven by a drive arm **224** that is, in turn, connected to a controlled extendable cylinder **226**. Extension of cylinder **226** from a first position (FIG. **26**) to its second position (FIG. **27**) drives suction cup **220** from a resting position (FIG. **26**) to an engaged pick up position (FIG. **27**) where suction cup is disposed adjacent to or disposed against edge **132** of pouch **110**. Each suction cup **220** is connected to a controllable supply of vacuum air flow so that suction cup **220** can engage pouch **110** with sufficient force to bend edge **132** down over stops **136**. When cylinder **226** returns to its first position, edge **132** is moved to its bent condition as shown in FIG. **28** where it is ready to be pulled from magazine **102** by pouch removal arm **140**. In this embodiment, pouch **110** is bent about pivot rod **222** or edge **138** and the stiffness of pouch **110** may keep it spaced from rod **222** as shown in the drawings.

One or a plurality of pouch removal arms **140** (FIGS. **29-36**) may be provided to slide pouch **110** from magazine **102**. Arms **140** are carried by a movable carriage **250** that slides up and down on a portion of frame **210**. Bearings **252** provide for a smooth sliding motion. A Arms **140** are adjustable mounted to carriage **250** such that they may be moved side-to-side as shown in FIG. **29**A for use with different-width pouches. Controllable cylinders **254** are used to drive carriage up and down as needed to place the grabbers **256** of arms **140** in the proper location for engaging pouch **110**. In another configuration, grabbers **256** may be combined with grabber **220** so that arms **140** move up to bend the pouch edge down and then remove the pouch from the stack of pouches in a single movement.

An adjustable stop **260** is used to control how far down pouch removal arms **140** move from magazine **102**. Stop **260** adjusts apparatus **100** for pouches of differing lengths. When magazine **102** is properly configured, edge **132** is always in the same location regardless of the width and length of pouch **110**. Stop **260** is thus used to limit how far arms **140** pull pouch **110** down from magazine. Stop **260** includes a selectively rotatable shaft **262** that carries a plurality of stop tabs **264**. Each stop tab **264** is positioned along shaft **262** in a position that corresponds to a different pouch length. The user sets the length of the pull down by rotating shaft **262** until the desired stop tab **264** is disposed under a portion of carriage **250**. Carriage **250** may include a fine adjustment finger **266** that engages stop tab **264**. Rotation of finger **266** allows for fine height adjustments so that the position of pouch may be precisely controlled when it is pulled down from magazine. Stop **260** allows apparatus to readily set up for different length pouches without extensive measuring.

FIGS. **33-36** show how first pouch **110** is slid out of pouch stack **104** and positioned in an upright position so that pouch opener **114** and shuttle **116** may perform their functions. Pouch holder **142** is disposed along the path of pouch **110** as it is pulled from stack **104** down to its "removed" position. Holder **142** applies a force to pouch **142** so that the pouch will not fall over or crumpled when it finally disengages from stack **104** before it is engaged by shuttle arms **150**. An exemplary holder **142** is a vacuum plate that applies a small vacuum force to the body of pouch **110** to keep it in its upright position. Holder **142** may be positioned toward or at the top of pouch **110** as shown in FIGS. **41-43** so that the upper corners are held in an uncollapsed position while provided space for shuttle arms **150** to engage pouch **110**. Another type of holder **142** is a body that defines a pair of slots that receive the opposite sides of pouch **110** as it is pulled down. The vacuum embodiment of holder **142** may be used to help open pouch **110** below.

An exemplary operation and the adjustability of shuttle **116** are shown in FIGS. **37-49**. An alternative configuration is depicted in FIGS. **68-71**. In an alternative configuration, shuttle **116** moves the pouch laterally from the direction depicted in these drawings. Apparatus may thus move one pouch to the right with a second pouch to the left in order to increase throughput. In the exemplary embodiment, a controllable drive is used to move shuttle **116** back and forth between its ready (FIG. **37**), intermediate (FIG. **43**), and second (FIG. **48**) positions. The controllable drive may be provided in any of a variety of those known in the art. In the exemplary embodiment, extendable cylinders are used to control the movement of shuttle **116**. Shuttle **116** may be slid between its first and second positions with shuttle cylinders **260**. In order to precisely control the intermediate position of shuttle **116**, an offset cylinder **262** is used to move shuttle **116** from its first position to its intermediate position. Fine adjustment screws **264** are used to provide for fine adjustments of the first and second positions. Screws **264** function to limit the movement of shuttle **116**.

As described above, shuttle **116** carries shuttle arms **150** that engage pouch **110** to move it from its pulled down position to filling station **118**. Arms **150** may also hold pouch **110** while pouch **110** is being initially opened. FIGS. **37** and **37**A show how the position of arms **150** may be adjusted on shuttle **116** for different pouch widths. Each arm is held on a slide **268**. In one embodiment, slides **268** are tied together so that a width adjustment of one arm **150** automatically moves the other arm **150** while keeping them centered about pouch **110**. Each arm **150** carries a controllable gripping finger **270** that is adapted to pinch and hold a portion of pouch **110**. Pouch **110** is engaged by arms **150** when fingers **270** pinch the edges of pouch **110** near the upper corners of pouch **110** as shown in FIGS. **40** and **39**.

Once pouch **110** is engaged by arms **150**, apparatus **110** opens pouch **110** so that it may be filled. The opening step may occur before moving pouch **110** away from the pull down position shown in FIG. **42** or an intermediate pouch position may be used between the pull down position of FIG. **42** and the filling position of FIG. **48**. The intermediate position allows second pouch **112** to be pulled down while shuttle **116** is delivering pouch **110** to filling station **118**.

Opening arm **152** pivots to engage the front of pouch **110** as shown in FIGS. **41** and **42**. Arm **152** includes an engagement device such as a suction cup **280** that can pull move the front of pouch **110** outwardly as arm **152** is retracted. Arm **152** may be controlled by a drive **282** and pivot rod **284**. Arm **152** is retracted away from pouch **110** to pull pouch open. In FIGS. **68-71**, arm **152** positions cup **280** in front of, but spaced from, the pouch. A drive **281** then moves cup **280** into engagement with the pouch as shown in FIG. **70**. The pouch is opened when either arm **152** pivots back up or drive **281** moves cup **280** back to its ready position. Arms **150** slide inwardly as shown in FIGS. **44** and **45** (through the use of controllable slides **268**) at the same time so that the sides of pouch **110** are moved toward each other to give the pouch enough slack to open. Air blast **156** is timed to coincide with

the retraction of arm **152** so that pouch **110** almost immediately fills with air and remains open after arm **152** has disengaged from pouch **110** as shown in FIGS. **43** and **44**. In the embodiment of the invention where pouch **110** is opened at the pull down position, the bag opening steps are performed while pouch removal arms hold the bottom of pouch as shown in FIG. **45** and while holder **142** optionally holds the rear of pouch.

In the exemplary embodiment, pouch **110** remains held by arms **150** while funnel **158** engages pouch to held hold pouch **110** in position while it is filled as shown in FIGS. **50-53**. Arms **150** release pouch **110** after transfer arms **160** engage pouch **110** as shown in FIG. **54**. FIGS. **57-64** show exemplary steps of filling and sealing the pouch. These mechanisms and methods are disclosed in U.S. Pat. No. 6,550,226, the disclosures of which are incorporated herein by reference.

Arms **150** may move straight back to the first position of shuttle **116** as shown in FIG. **56** or arms **352** may be provided as shown in FIGS. **72-78** that move out and around second pouch **112** after arms **352** have delivered first pouch **110** to filling station **118**. Arms **352** may pivot with respect to shuttle **116** so that they may be moved around pouch **112**. Drives **354** control the pivoting movement. The method shown in FIGS. **72-78** increases the throughput of apparatus **100** by allowing pouch **112** to be pulled down while pouch **110** is being delivered to filling station **118**.

FIGS. **65-67** depict an alternative configuration for pouch magazine **102** wherein a second stack of pouches **104** is carried above and spaced from the first stack of pouches **104**. When the first stack **104** is exhausted, magazine **102** pivots its retaining fingers **170** from the holding position of FIG. **66** to a release position of FIG. **67** to allow the upper stack **104** to drop into the bottom of magazine **102** where the pouches are removed by the pouch separator. Drives **172** such as pneumatic cylinders are adapted to pivot fingers **170** back and forth between the two positions. The configuration of magazine in FIGS. **65-67** allow the user to load twice as many pouches into apparatus **100** to allow the operator more time to monitor the aspects of apparatus.

In the foregoing description, certain terms have been used for brevity, clearness, and understanding. No unnecessary limitations are to be implied,therefrom beyond the requirement of the prior art because such terms are used for descriptive purposes and are intended to be broadly construed.

Moreover, the description and illustration of the invention is an example and the invention is not limited to the exact details shown or described. The different elements of apparatus may be used singularly in combination with other apparatus configurations in combination with one another to define apparatus and methods.

The invention claimed is:

1. A method for removing a first couch from a plurality of adjacent pouches; the plurality of adjacent pouches including a second pouch disposed immediately adjacent to the first pouch; each of the pouches having edges; the method comprising the steps of:

bending an edge of the first pouch away from the second pouch to define a bent edge and a bend in the first pouch;

pulling the first pouch away from the second pouch by the bent edge of the first pouch to remove the first pouch from the plurality of adjacent pouches; and

pulling the first pouch over a vacuum plate that holds the first pouch in a non-collapsed condition.

2. The method of claim **1**, further comprising the step of engaging opposite portions of the pouch with shuttle arms and moving the first pouch to a loading position.

3. The method of claim **2**, further comprising the step of pulling the second pouch over the vacuum plate while the first pouch is in the loading position.

4. The method of claim **2**, further comprising the step of opening the first pouch before the first pouch reaches the loading position.

5. The method of claim **1**, further comprising the step of vibrating the plurality of adjacent pouches before the first pouch is removed from the plurality of adjacent pouches.

6. The method of claim **1**, wherein the second pouch is disposed in a reference plane and further comprising the steps of

bending the edge about an axis disposed in a direction parallel to the reference plane; and

pulling the first pouch in a direction non-parallel to the reference plane.

7. The method of claim **6**, wherein the step of bending an edge includes the step of bending the edge more than 30 degrees from the reference plane.

8. The method of claim **7**, further comprising the step of engaging the edge of the first pouch with a suction device and bending the edge by pivoting the suction device.

9. The method of claim **8**, further comprising the step of moving the edge of the first pouch over a static stop during the step of bending the edge of the first pouch away from the second pouch.

10. A method for removing a first pouch from a plurality of adjacent pouches; the plurality of adjacent pouches including a second pouch disposed immediately adjacent the first pouch; each of the pouches having a body and edges; the second pouch having first and second edges with the pouch body disposed in a reference plane; the method comprising the steps of:

pivoting a first portion of the body of the first pouch about an axis disposed intermediate the first and second edges of the second pouch;

separating the remaining body portion of the first pouch from the second pouch by moving the first portion of the body of the first pouch in a direction non-parallel to the reference plane of the second pouch to pull the remaining body portion of the first pouch across a portion of the second pouch to the pivot axis where the first pouch is separated from the second; and

pulling the first pouch over a pouch holder having a vacuum that holds the pouch in an non-collapsed position.

11. The method of claim **10**, further comprising the step of engaging the first body portion of the first pouch with a suction device and pivoting the first body portion by pivoting the suction device.

12. The method of claim **11**, further comprising the steps of moving an edge of the first pouch over a static stop during the pivoting step and catching an edge of the second pouch on the static stop.

13. A method for removing a first pouch from a plurality of adjacent pouches; the plurality of adjacent pouches including a second pouch disposed immediately adjacent and in contact with the first pouch; each of the pouches having edges; the method comprising the steps of:

bending an edge of the first pouch away from the second pouch to define a bent edge;

moving the edge of the first pouch over a static stop during the step of bending the edge of the first pouch

away from the second pouch and catching an edge of the second pouch on the static stop;

pulling the first pouch away from the second pouch by the bent edge of the first pouch to remove the first pouch from the plurality of adjacent pouches; and

applying a vacuum to the first pouch to support the first pouch in an uncollapsed configuration while the first pouch is being removed from the second pouch.

14. The method of claim **13**, further comprising the step of supporting the first pouch in an uncollapsed configuration after the first pouch is removed from the second pouch.

15. The method of claim **14**, further comprising the steps of filling and sealing the first pouch.

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